

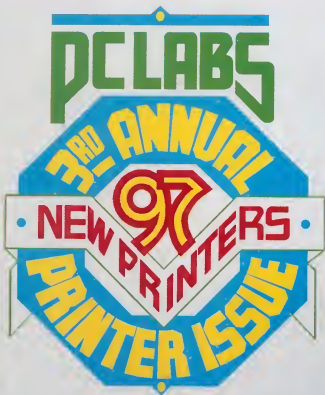
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AT LAST, A READABLE
LAPTOP: THE Z-181

MAGAZINE

VOLUME 5 NUMBER 19
NOVEMBER 11, 1986

- Dot Matrix:
Faster,
Friendlier,
More Colorful
- Die-hard
Daisy Wheels
- Lasers as
Low as \$1,995
- Exciting New
Laser Engines



45

45

How Borland is helping bring the America's Cup back to America!

"I think those who grasp the technology will prevail"

Bill Shore, President,
Shore Sails Co., Newport, RI



HEART OF AMERICA

Borland's Philippe Kato at the helm of America's Cup challenger "Heart of America," with Shore Sails' President Bill Shore

"Sail-making is traditional—a craft—but I think we're huge steps ahead of the competition when we get involved with higher technology," says Shore.

He and Shore Sails' 17 different franchised sail lofts in the U.S. are in what Shore describes as a "highly competitive business, whether it's America's Cup racing or any race." And he adds, "You guys (Borland) do good stuff that's affordable, which is one of the reasons why we wrote all our sail design programs in Turbo Pascal."

"These days," he says, "there are many parts to a sail, and Turbo Pascal lets us arrange all the parts properly. We design what the garment industry calls a 'marker'—and rely on Turbo Pascal to do critical things like getting thread lines in the same direction as load lines.

We take the diskette to our new \$250,000 laser cutter, which follows the Pascal program precisely, draws out the sail and cuts out the sail. We glue and sew and you've got the best there is."



"Heart of America" sporting its new Borland sprinker, surfing downwind, Santa Cruz, California

"The wrong sails will sink your chances—if not your boat—so we wrote Turbo Pascal programs"

Win Fowler, Shore Sails Co.,
Portland, Maine

The right sail design, at the right price, right now, has to happen in 17 different Shore Sails Lofts across America.

It had to happen with America's Cup challenger Heart of America which carries Shore sails—and it has to happen with the (currently) 700 different boats that Shore Sails has in their Turbo Database Toolbox."

Sail design, sail pricing and "beating the handicapper" are all done at Shore Sails with Turbo Pascal.

In case you don't know the sharp end from the blunt end of a boat, the right sail design for any boat is more than design and price. It's tactical advantage. Designing sails that take the greatest advantage of the boat's basic design and rigging without getting stuck with a heavier-than-desirable Official Handicap. (Handicaps can eat your chances faster than a Great White.)

The "right sail" design bends but doesn't break the

racing rules written by, amongst others, MORC (Midwest Offshore Racing Club) or IOR (International Offshore Rules). Turbo Pascal spills out "right sail" designs for Shore Sails so their customers tend to "handicap" the Rules Committee instead of the other way around.

Shore Sails' connection with Borland doesn't end with Turbo Pascal and our Database Toolbox.

Shore's Fowler has also written SuperKey macros for "every file we have" and says, "We'd be lost without them."

He uses SideKick™ to dial every phone call and SideKick's Notepad to communicate between all the Lofts, saying, "That way we don't need a word processor."

Shore Sails also uses Turbo Lightning™ and Reflex: The Analyst.

So why so many Borland products in one company?

Win Fowler says, "We'd be sunk without them!"

"There is no second prize" Omar Bradley

Sail designs generated from Shore Sails' Turbo Pascal programs



Borland's Instant Winner Game

Scratch this card now and you could *instantly* win 2 free round-trip airline tickets to Australia for the America's Cup Race!



\$10,000

First Prize (\$10,000 value!) includes accommodations for two in Perth, Australia during the final America's Cup races, which start January 31, 1987. See America win it back after our *only* loss in 134 years! There's more than one *instant winner* in Borland's Instant Winner Game, because you could win one of two new \$6,895 4-WD Suzuki Samurai convertibles, or a \$4,995 AST TurboLaser™ printer, or a \$4,499 Toshiba T3100,™ or a \$2,399 Toshiba T1100™ Plus, or a \$595 AST SixPakPremium™, or a \$69.95 Traveling SideKick®, or any one of hundreds of other Borland products—and at the very least a Borland Rebate Coupon, good for \$10 off any single product or \$15 off any bundled product offer!



\$6,895



\$4,499



\$69.95

See Official Rules on the back of this card for details.

Don't delay! There will be a second-chance drawing for the trip if not claimed by 12/31/87. There's also a second-chance drawing for the two Suzukis if not claimed by 2/28/87. All rebate coupons are good for products purchased 8/1/86-3/31/87. Product prices above are suggested list prices.

Rub the silver box to reveal whether you win a prize or get a rebate coupon. Then fill in the second-chance entry blank to the right.

**SCRATCH
'N WIN!**

Second-Chance Sweepstakes Entry!

We're running two Second-Chance Sweepstakes drawings to award the trip and cars. They will be won by someone—it *could be you!* Fill in the entry coupon and mail it now. Winners will be notified immediately, because the final America's Cup races start in Australia on January 31, 1987, and you'll have to pack in a hurry.

(You will need a valid passport and the ability to comprehend Australian versions of the English language.)

Name _____
Address _____
City _____
State _____ Zip _____

OFFICIAL RULES - BORDLAND INSTANT WINNER GAME

1. NO PURCHASE NECESSARY: To participate, you may obtain a game card inserted into the Official Winner Game, or January 30, 1987, or any of the following magazines: PC World, Byte, PC Tech Journal, PC Magazine. You may also obtain a game card by making a self-addressed, stamped envelope to: Bordland International Game Card, P.O. Box 870, Waco, CT 06097 (Washington State residents send self-addressed envelope.) Limit one game card per stamped request. All requests must be received by January 15, 1987.

2. TO PLAY: Remove the tab-off area on the game card to reveal what prize or rebate offer you have obtained.

3. PRIZES/REBATES: Beneath the tab-off area one of the following prizes may be revealed: Trip for Two to America's Cup Races or \$10,000; 1988 Suzuki 4W Samurai Convertible or \$8,895; AST Turbo Laser; Toshiba 1100 Portable Computer; Toshiba 3100 Portable Computer; AST Synapse; AST Advantage; AST 3D Pak; AST Rampage; AST Rampage AT; Free Bordland Product, or you may obtain the following rebate offer: \$10 rebate offer on any individual product or \$15 rebate offer on any single advertised Bordland item (See rule #11 for prize details.)

4. PRIZE CLAIMS: If you obtain one of the prizes stated in Rule #3, sign your full legal signature on the game card and send a certified mail (copy should be made for your records) along with your name and address to: Bordland International, P.O. Box 188, Danbury Road, Wilton, CT 06097. All prize claims must be received or postmarked by February 15, 1987. (See Rule #12 for Trip for Two to America's Cup Races.)

5. REBATE CLAIMS: Rebates are good for products purchased from September 5, 1986 through March 31, 1987. The \$10 rebate is good for any individual Bordland product and the \$15 rebate is good for any advertised Bordland software bundle. To receive your rebate you must return your completed rebate agreement from the nearest, this game card and dated proof of purchase to: Bordland International, Game Card Rebate, 8585 Scotts Valley Drive, Scotts Valley, CA 95008. Upon receipt of the license agreement, game card and proof of purchase, Bordland will send your check. Rebate is not valid with any other rebate or promotion offered directly from Bordland.

6. VERIFICATION: All game statements are subject to verification. Game materials are void and will be rejected if not obtained through authorized, legitimate channels, and may be rejected if any part is reproduced, counterfeited, lost or altered in any way, or if materials contain profanity, typographical, or mechanical errors. Decisions of the Redemption Center are final. Game pieces from any game other than the Bordland Instant Winner Game may not be used in this game.

7. CONDITIONS OF PARTICIPATION: Material submitted becomes the property of Bordland International. The submission of game pieces is the sole responsibility of the individual seeking verification, who is solely responsible for lost, late, or undelivered mail. All taxes, registration and inspection fees are the sole responsibility of the verified winner. Winner may be required to execute an affidavit of eligibility and name and address publicly release. By participating in the game you accept and agree to be bound by these rules and the decision of the Official Redemption Center which will be final.

8. ELIGIBILITY: Participation is open solely to residents of the United States 18 years of age and over, except employees and agents of Bordland International, service agencies, and individuals engaged in the development, production, or distribution of game materials. The Board Group, Inc. and their immediate family or members of their households. Void in Vermont and where prohibited by law.

9. GAME SCHEDULE AND AWARD OF PRIZES: The Bordland Instant Winner Game will commence on or about September 5, 1986 and end on January 30, 1987. It will officially end, however, when all game pieces are distributed. Verified game pieces will be awarded within thirty (30) days from the date of their receipt for verification at the Official Redemption Center. A major prize winner! Will be obtained by sending a stamped, self-addressed envelope to: Bordland Instant Winner Game Winner, Inc. P.O. Box 7088, Waco, CT 06097.

10. ODDS CHART: The odds of winning prizes are based upon obtaining the one rare game piece among the applicable number of game pieces.

PRIZE	Qty.	Total Value	Sale of Winning
Trip for Two to America's Cup or \$10,000	1	\$ 10,000.00	1 in 6,454,300
Suzuki 4W Samurai Convertible JA or \$8,895	2	\$ 17,790.00	1 in 3,227,150
AST Turbo Laser	1	\$ 4,895.00	1 in 4,454,300
Toshiba Portable Computer	2	\$ 8,895.00	1 in 3,227,150
AST Memory Boards	25	\$ 15,025.00	1 in 254,320
Bordland Products	1,003	\$148,000.00	1 in 2,454
OVERALL TOTAL	1,031	\$158,790.00	1 in 2,294

All winning game cards will contain a \$10 rebate good on any individual Bordland product or a \$15 rebate good toward any advertised Bordland software bundle.

11. PRIZE DETAILS: Trip for Two to America's Cup Races (or \$10,000) will include coach class round trip airfare on regularly scheduled commercial airlines from San Francisco, California to Perth, Australia and up to two weeks hotel accommodations in Perth, Australia plus \$4,500 spending cash. Winner will be responsible for obtaining visa, passport, and all other travel documents. Trip does not include meals, taxes, excess baggage charges and other hotel charges. Motor must be accompanied by parent or legal guardian.

Suzuki 4W Samurai Convertible (a Standard Equipment Package) or \$8,895, verified winner will be responsible for all registration, insurance, and licensing fees. AST Turbo Laser, Toshiba Portable Computer Model # T1100, AST Memory Boards and Free Bordland Products are non-substitutable except by sponsor due to product availability and all warranties and guarantees are subject to manufacturers terms. All prizes are non-transferable. Winning consumer is responsible for all local, state and federal taxes.

12. SECOND CHANCE SWEEPSTAKES: There are two Second Chance Sweepstakes scheduled to be conducted on December 31, 1986 and February 28, 1987. Random drawing from all entries received by December 30, 1986 will award trip for two to America's Cup Races (or \$10,000). Random drawing from all entries received by February 28, 1987 will award two (2) Suzuki 4W Samurais (or \$8,895). All remaining prizes that are unclaimed after February 15, 1987 will remain unclaimed. Send entry to: Second Chance Entry P.O. Box 870, Waco, CT 06097.

If you have any questions concerning the Bordland Instant Winner Game, call 1-800-451-4471.

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to cost \$124.95 is now only \$99.95! You now get a lot more for a lot less: the compiler, a completely integrated programming environment, and BCD reals and 8087 support—all for a suggested retail of only \$99.95. And with a Scratch 'n Win \$10.00 Rebate, you pay only \$89.95—which really is the "language deal of the century"! Minimum memory: 128K.

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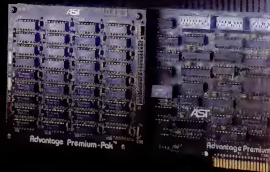
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COVER STORY

The Third Annual Survey: Printers

John Dickinson/Competition in the printer category has been heating up steadily in the 3 years that *PC Magazine* has been putting out its annual [printer guide](#). This year, 97 new dot matrix, daisy wheel, and laser machines join the 190 printers reviewed in *PC Magazine* in the previous 2 years. You'll see each new printer has lots of competition. Following this discussion, you'll find the **Printer Guide**, which presents benchmark test results and print samples ... 135



Laser Printers

Two years ago this category was owned by the Hewlett-Packard Laserjet printer. Dozens of printers have entered the scene, offering features that distinguish them from the HPs—some even priced below \$2,000. Since the original HP Laserjet offered superb print quality, excellent fonts, and fast, quiet printing, you see that lasers are the hottest printer-market segment. 261



Dot Matrix Printers

Today's dot matrix printers are numerous and nice. This is the largest of all printer categories, and the machines are almost uniformly good quality, inexpensive, easy to use, and reliable. But do any stand out?



Daisy Wheel Printers

The squeeze is on in the daisy wheel printer category: from the bottom up come correspondence quality dot matrix printers; from the top down crash low-cost lasers. What will the future hold for the die-hard daisies? 305

The Ricoh Laser Engine: Challenging Canon's Laser Technology

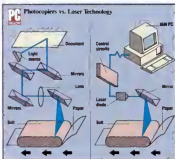
Bill Harts There's a new kid on the block, the Ricoh LP4080 laser engine, and in the past year it's gained a wide following. *PC Magazine* takes a look at what the Ricoh offers and how it works. 353

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For the past three years358

Dariusz Wierczys — 8799 (in 8) 2005

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WHAT'S INSIDE



As the number of PC products in any category soars, editors at some magazines shake their heads over the logistical nightmare of doing comprehensive reviews and plot ways to reduce the burden.

Take printers, for example. With 97 new machines emerging in the past year, one labor-

saving method might be to trim the list of machines for review to several of the famous names (Epsons, Okidatas, NECs, and other "haves" of the printer world) along with several of the big advertising spenders (don't bite the hand...) until you have a manageable cast of a dozen. It's easier on the budget that way, and readers are sure to find at least one device that's interesting. Another method is to toss the makers of unreviewed printers a bone: mention the price and a few of the features, and list everybody in an innocuous table of features.

PC Magazine uses the direct approach. If there are 97 new printers, then we'll test and review 97 new printers—in-depth.

Readers like our approach. Three years ago, when the inaugural Project Printers blockbuster covered 119 printers, the issue proved so popular that at least one corporation had to drill a hole through its copy and chain it to a desk, lest it be stolen. Last year we reviewed 70 printers, and this year, 97 more, plus a half-dozen last-minute entries covered in the First Looks section (page 33).

A printer's two most important characteristics are speed and print quality. PC Magazine's speed test has been updated and now takes into account the abundance of laser printers. The test continues to reflect a real-world situation—a two-page business letter—rather than a test of burst speed that often shows printers to be twice as fast as they really are. Laser printers are slow to produce the first page but then spit out additional pages in rapid succession—so this year the laser test has been expanded to eight pages.

Our masthead of editors (page 4) shows a number of familiar names in new positions this issue as a result of several promotions announced by editor Bill Machrone. Senior editor Bill Howard and managing editor Luisa Simone join Paul Somerson as executive editors.

Gus Venditto, formerly a managing editor at PC Magazine, becomes senior editor in charge of First Looks—11 pages with a late-closing deadline that gives readers the first hands-on reviews of major new products.

New as assistant managing editors are Greg Pastrick and Paul Ross, Diane D'Angelo is the new production editor, and editorial assistant David Baker is now assistant to the editor.

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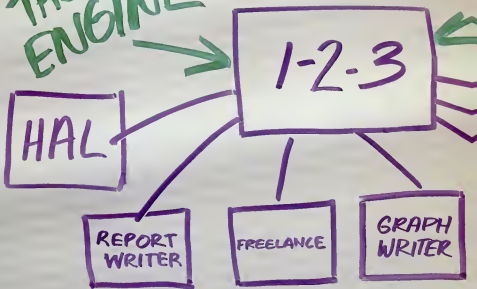
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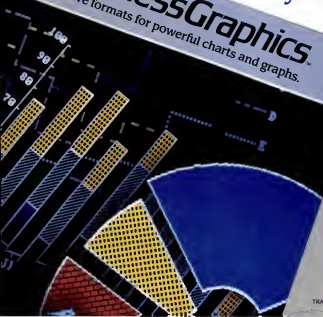
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Boot your PC. Type
S&G. When the
menu screen
appears, use the
cursor to select any
of 12 formats for
your graph. Then
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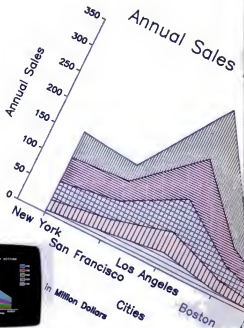
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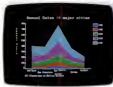
2

Press F4 and (RTN) to bring up the Stella Data Entry Spreadsheet. Enter data and labels. Or, select an existing graph file and press the (RTN) key. Then press (ESC).



3

Your graph will be on-screen, like this. To print it out, just turn on your printer and press F5. That's the power of simplicity.



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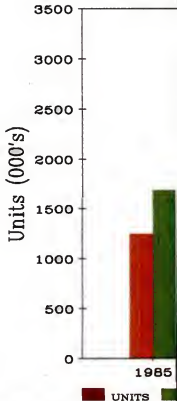
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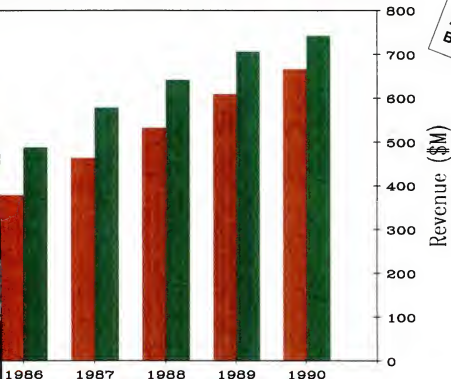
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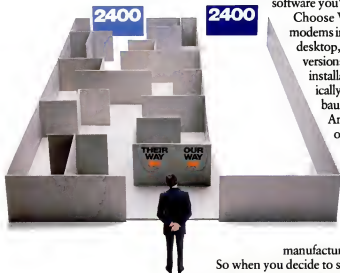
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LETTERS TO PC MAGAZINE



BUSINESS FORECASTING

I was amazed to see *SmartForecasts II* as an Editor's Choice in your article "Business Forecasting: 16 Ways to Predict the



Future" (*PC Magazine*, Volume 5 Number 14). It will not forecast individual items based on their unique sales history in an automated fashion. The program turns a PC into a glorified calculator that must be hand-fed instructions item by item. Surely if you had used the product, you wouldn't so highly recommend something so labor sensitive. This Editor's Choice is particularly galling to me because we initially bought the program based on your recommendations last year in a similar article.

Dan Sharpe
Corona, California

Author Marvin Bryan replies:

Mr. Sharpe's complaint about SmartForecasts II is not that it is inaccurate or that it will not provide him with the information he wants but rather that it is not fully automatic. The Fact File accompanying the review stated very clearly that it is "command driven." Its automatic mode is unusual and welcome, but the program cannot be expected to perform all forecasting tasks automatically. SmartForecasts II is easy to use compared with the average statistical package and is surprisingly powerful, and these are the reasons why it was recommended. It has also been chosen over the competition by the Pentagon, NASA, General Electric, and TRW.

The summary of features table for the article "Business Forecasting: 16 Ways to Predict the Future" states that our *SORITEC* econometrics system will not handle problems having more than 85 variables or 100 cases. This is not correct. The PC version of *SORITEC* is limited only by the total number of data points (about 8,500) that can be handled by each individual command. Each command, however, can use a completely different set of data points. The *SORITEC* databanking facility will manage much larger data sets, constrained only by available disk space. *SORITEC* has no internal design limitation which constrains the problem size; the constraint with respect to the capacity of a single command arises only from the limited RAM space available on the PC.

John D Sneed
President, The Sorites Group, Inc.
Springfield, Virginia

Marvin Bryan replies:

Your statements are correct. However, I obtained this information directly from your company and can only suggest that

■ We've run many PCs stuffed to the gills with accelerator boards of all descriptions and have never experienced a serious heat problem.

there was a misunderstanding in our conversation.

TOO HOT TO HANDLE

The articles "Accelerator Boards: Power for a Price" and "The No-Slot Alternative to Acceleration (And Why It Makes



Sense)" (*PC Magazine*, Volume 5 Number 15) are the best reviews on accelerator boards to date. Their treatments were thoroughly comprehensive.

Unfortunately, neither article

mentioned that while accelerator boards are indeed able to increase the speed of a PC, they also generate a lot more heat. In fact, IBM has recognized the overheating potential of the PC by instituting changes in its most recent PCs and PC-XTs. Those changes include a larger power supply fan tilted inward, less-restrictive air-intake orifices in the power supply case, and a cover on the chassis air-intake orifices under the disk drive area. However, our tests indicate that IBM's design changes still aren't enough to combat excessive heat buildup, especially in loaded PCs and PC-XTs.

Helen C. Lawson
San Antonio, Texas

We've run many PCs stuffed to the gills with accelerator boards of all descriptions and yet have never experienced a serious heat problem (of course, this could be due to the fact that we often leave the covers off our PCs because of excessive board swapping). However, if you do find your PC is running warmer than usual, be sure there

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LETTERS

are air passages in the front and back of your system. You may also want to install a larger fan than the one supplied with a PC.—Ed.

GO AHEAD, MAKE A COPY

I recently acquired a free copy of your PC Labs Laboratory Benchmark Series Hardware Performance Tests at the National Computer Conference in Las Vegas. I would like to copy the disk, but since it is copyrighted, I will not do so unless granted permission. What procedures must I follow to get that permission?

James F. Wendelken
IBM Technical Evaluation Center
Austin, Texas

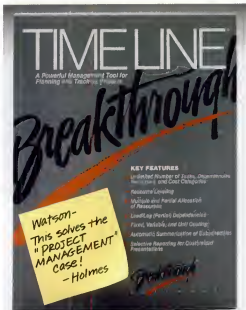
PC Magazine has put the Hardware Performance Tests into the public domain to give it the widest possible exposure. While all other programs that appear in this magazine are copyrighted and cannot be freely distributed without our express written permission, please feel free to make as many copies of the Hardware Performance Tests as you like.—Ed.

XENIX UNTRUE

I was unpleasantly surprised by your favorable review of Xenix System V for the IBM PC AT ("Xenix System V: A Multiuser Answer for the AT?" PC Magazine, Volume 5 Number 14). As a computer consultant, I am involved in UNIX and C development, and I've had the opportunity to work with Xenix from the early days when it was introduced on the Radio Shack Model 16 (Version 7-based) to the present System V. I do not believe that Xenix is as good as your reviewers stated.

Xenix System V for the PC is not true System V. The file system still contains some archaic references to Version 7, and some of the administrative files are hybrids between Version 7 and System V. Although most of these inconsistencies may be considered insignificant by the naive UNIX/Xenix user, they are nevertheless nonstandard features.

On the other hand, the AT&T 6300 Plus runs True Blue UNIX System V and includes a bonus of a DOS-like environment. The UNIX on the 6300 Plus is also faster and more user friendly, including a windowing environment with which a new



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LETTERS

■ *PC Magazine* has put the Laboratory Benchmark Series Hardware Performance Tests into the public domain; so feel free to make as many copies as you like.

user can browse through the system with ease. While I do not wish to sound like an advertisement for AT&T, I am surprised that Robin Raskin and Kaare Christian did not mention a product that would certainly give Xenix a run for its money.

Alan Buckwalter
Denville, New Jersey

Robin Raskin replies:

The question of "What is UNIX?" is still somewhat open. Today a version of UNIX can claim to be compatible with UNIX System V if it conforms to AT&T's System V Interface Definition. Xenix does indeed have some system administration features that differ trivially from those in an AT&T System V, but in the major areas of user-level contention between various UNIX systems, such as the ps and stty programs, Xenix is squarely in the System V camp. As to Xenix's omission of the features that you enjoy on the 6300 Plus, I have to agree, and I would like to see these same features in Xenix.

MORE MENUS

In the article "Menu Generators: DOS Made Easier" (*PC Magazine*, Volume 5 Number 11), Vincent Puglia states that *Fixed Disk Organizer* is limited to 45 programs. While it is certainly true you can have only nine options per page and five pages per menu for an apparent limit of 45, each of those nine options can lead to a submenu, which in turn can have nine options and five pages. And each submenu can lead to yet another submenu. I have

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- ☐ **GAMES 6** — Pinball, Ohello, Dragons, Sopwith (fly only), and more Color gr req'd
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LETTERS

found no limit to the number of entries.

As to the reviewer's comment that you have to rewrite the batch file so that *Fixed Disk Organizer* can regain control, all you have to do is include CDV and AUTOEXEC in the last two lines of any batch file.

John J. McCaffrey
Sebring, Florida

You're right. *Fixed Disk Organizer* does allow users to daisy-chain submenus. And your suggestion about regaining control is good; however, if other menu programs are capable of regaining control on their own, you shouldn't have to do it yourself.—Ed.

CORRECTIONS

Red River Technology, maker of the Atlas Board Kits ("Two Build-Your-Own Alternatives for AT Power," *PC Magazine*, Volume 5 Number 14), is no longer in business.

OmniTel's new modem, Encore 2400 HB (First Look, page 44, *PC Magazine*, Volume 5 Number 14), is Hayes compatible.

Source Print, Version 1.21b, from Aldebaran Laboratories costs \$139 (Reviews in Brief, "Formatting Program Code and Beyond: Aldebaran Labs' Source Print," *PC Magazine*, Volume 5 Number 15).

The line reading "12, 07, FF," in Figure 3 of PC Lab Notes ("Give Your PC Added Utility," *PC Magazine*, Volume 5 Number 14) should be "OC, 07, FF."

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dbc Lattice Library Maintains dBASE Compatible Files With the Power and Speed of C

dbc™ links C to dBASE. It creates and maintains files and their indexes which efficiently replicate dBASE file designs. C dBASE can read and update them. And the reverse: dBASE can use any files created by dbc. Now C dBASE and can operate on the same data bases interchangeably.

That opens up the widespread culture of dBASE installations to exploitation by C programmers. Tap that market, avoid the redundancy dBASE language, and open the advantages of C with this simple product. dbc's functions parallel all dBASE's file handling commands, merely decomposed to give greater control. Backed by demo source files on disk.

WINDOWS for C/WINDOWS for DATA Microsoft Windows™ and TopView™ Compatible

WINDOWS for C™ is a library of over 80 functions to add the power and practicality of window partitioning to your application. Unlimited windows each defined in a C-structure for easy reference throughout your program, can be made either to pop up or permanently overlay the screen. Windows will scroll and highlight lists with arrow keys, will read and scroll ASCII lists vertically and horizontally in windows, and even write to memory-loaded files off the screen. Logical treatment of video attributes permits unchanged programs to run on color or monochrome. Colors of windows are set individually.

All functions are in separate modules only those used are linked. Only buffers holding on screen or temporary obscured windows occupy RAM. Others released dynamically. Best overall rating and fastest response in June's 7/88 Tech Journal review of five windowing products.

Windows for Data™ comprises all of Windows for C but takes in data through the windows as well. At the high level a single function lets you specify print string, field length, data type, screen location, picture, target variable, then edit user functions scrolling to get and process a user's input. There are utilities to get system date and time, mess with strings, create your own masks for fields.

Field options can require entry prevent entry points insert or overwrite, keeping an invalid or overflow keypress, and attachment of field-specific help messages.

C-TREE B-Tree File Manager, Source Code, No Royalties!

C-tree is a study code that has weathered many seasons of prolonged and widespread use. It comes in C or C++ versions, or can be modified to fit a special case. No royalties provided you commit it to your library application.

C-tree's design adds nodes to allow any number of users to access an index file simultaneously even when updates are in progress. So multi-user configurations and adaptation to networks are possible. Record-locking routines are provided for.

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and functions you were called to display messages or validate entries. And you decide which keys will clear a field, jump to the next or prior card, etc. Options dense enough that a set of "fields" can be made to behave like a Lotus™ menu.

Specify Compiler: **Lot** **PC Board**
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MICROSOFT C 4.0 A Great C Battle Rages and You're Winning

As the deadweights pound each other with ever heavier ordnance, today's programmers reap the spoils of this war. Bunting a source debugger and a "make" and spicing a "bake" memory model, creating single data objects larger than 64K, the Microsoft C compiler has jumped a full version number to 4.0. But what's really impressive are the bench marks reported in Dr. Dobbs (8/88):

The CodeView™ debugger, free for a limited time, uses windows to show every line on one screen alone alongside disassembled object, variables, stack and registers. Drop down windows: use a mouse if you like—choose learning of commands. A source-level debugger that puts the rest

DOS 3.1/3.2 UNIX and XENIX
Thanks to source code which does not deviate from the K&R standard, C-tree can be used in many environments. That C-tree gives your application a ticket to anywhere.

C-tree permits any number of keys for a data file, supports duplicate keys, alphanumeric or numeric; supports files of variable record length, multiple keys in one field, and keys of variable length. Both high level ISAM routines which handle details with minimum coding and decomposed step-by-step functions you can access directly in the comprehensive.

Ask for: **Lot** **PC Board**
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Writing your own screenware can be a slow completion days job. Panel™ works with you interactively to set up foolproof screen displays and data entry forms rapidly. Output is C source code.

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to shame! (Dobbs). Microsoft C now has five memory models for code and data, plus no library support for another thirteen, and speeds alternate math packages for speed versus accuracy, with or without 8087/8088 chips. A bag plus in multi-language settings: call from this C any routine written in later versions of MacPascal, FORTRAN or Macro Assembler. Object code of all four may be intermixed any time or conjoined into libraries.

Both linker and library manager are part of the package, as is the "make" a UNIX™ name for a similar batch program which knows to expand manifests often to rebuild any size of project by compiling and assembling only elements affected by new or changed files.

It is reportedly used by Lotus, Ashton-Tee and Intrepid Microsoft said to develop Windows. Dobbs calls it "the best MS-DOS C development environment value today!" (very nearly any kind of praise conceivable. 32K suggested).

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Curves from Lattice™ manages the screen of the PC like Unix™ curses. Library of 44 functions and macros parallels Unix with matching parameter lists. So Unix programs can be at home on the PC, and vice versa. Keeps any number of screens in memory, supports color, was function set to get characters, wrap lines, scroll, blank lines, highlight, etc. Lattice Unix refreshes screen only on your command. Ask for: **Lot** **PC Board**
L0680 **125** **Here** **199** **With Source**
L0680 **1250** **199**

checking user field entries. Diverse attributes may be selected for any field—size, data type, color, conversion of input to upper case, clearance of existing data when new entry is started, masks for standard formats (eg dates), phrases which fill in when their first letter is typed, multiple-choice lists from which to choose by choosing a highlighted bar. Fields may be multi-line and scrolled if larger than the screen space allocated them. Specify: SGLS & Compiler. List \$295. Us \$229.

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Lotus® didn't do badly pulling it all together in one place. Phoenix has followed suit with the ultimate integrated C library, offering everything from low level functions for hardware access to complete in-line database management. Along the way are prerequisites such as string manipulation, timestamp, file and screen editing, but also four styles of menus (Lotus included), windows, background tasking, DOS interfaces, directory management, even interrupt-driven communications. Design emphasizes objects, so characteristics of views, databases, records and fields can be mutated and changed under functions.

One large collection in place of bits and pieces means one set of instructions and *Phoenix* has tutorials, extensive examples, quick reference, and on-line help.

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DAN BRICKLIN'S DEMO PROGRAM *Storyboard Your Program*

The legendary One has created Metaphase 2. When the rest of us are still on Dos, Dan's first was the original electronic spreadsheet (*VisiCalc*®). This one is for programmers.

Worlds don't express program ideas because programs are screens! Dan's Demo creates slide shows. Create a screen — a snapshot of your planned program as it runs. Apply color, borders, box rules, underlines, and underlining of monochrome, fore- and background color. Copy this "slide" to an empty screen. Sprinkle it with the show the next instant of runtime. Do it again. Presto, a whole slide show of your program in action.

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Codemith-88 Debugger by Visual Age	145	109	GSS Graphics Development Toolkit	495	399
Debugger by Micro-Software Developers	165	139	GSS Kernel System by Graphic Software	495	399
CSD Debugger C source level by Mark Williams	75	75	GSS Kernel System for IBM RT	795	676
Sprite Debugger by Lattice source level	135	119	GSS Metaphase 2 Interpreter	795	676
Microsoft Macro Assembler with Utilities	150	109	GSS Plotting System	495	399
PASMB8 by Phoenix, Macro Assembler	195	148	Halo Graphics Kernel System	300	219
Periscope I Debugger Data Base Decisions	295	260	with Dr. Hal's, by Media Cybernetics	440	299
Periscope II Data Base Decisions	295	260	COMMUNICATIONS	175	148
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BASIC LANGUAGE	195	165	Greenleaf Communications by Greenleaf	195	148
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BetterBASIC Utilities 8087 Math Support	95	85	Software Horizons Pack 3	149	119
Brivve Interface	250	225	UTILITY LIBRARIES	175	148
RunTime Module	95	85	Blaise C Tools Plus C Tools 2	125	100
Microsoft BASIC Interpreter for XENIX	350	295	Blaise C Tools 2	100	89
Microsoft QuickBASIC Compiler full BASIC	99	79	C Food Forge/based by Lattice	400	300
Professional BASIC by Morgan	480	400	C Utility Library by Essential, 300 functions	185	139
RA/BASIC by Ryan-McIntosh	150	119	Greenleaf Functions by Greenleaf Software	185	139
True BASIC true BASIC Inc.	150	119	PhorC by Phoenix, vast library	475	349
Run Time Module	500	420	Software Horizons Packages	Var	Call
True BASIC Libraries Brivve, Asyn, Sort, etc.	Var	Var	TopLine Tool based by Lattice, source avail	250	199
C & C++ COMPILERS	395	290	DEVELOPMENT TOOLS	119	99
C-86 Compiler Computer Innovations	395	290	Code Sifter by David Smith Software, Profler	295	269
Lattice C Compiler from Lattice	75	69	C-Worthy by Custom Design Software	495	449
Let's C Compiler by Mark Williams	150	129	C-Worthy for Network Mems, help, errors	75	69
with CSD Source Level Debugger	495	369	Dan Bricklin's Demo Program Prototyper	185	149
MPC-86: Mark Williams C Development	450	290	LMK from Lattice by Lattice, "make" like UNIX	500	395
Microsoft C Compiler 4.0	395	290	Microsoft Windows Development Toolkit	139	125
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Brivve by Brivve, no royalties	255	195	RA/FOUR by Ryan-McIntosh	295	269
Better Network, by Softcraft	295	249	Scientific Subroutine Library by Phoenix	175	149
c-tree by FanCom — no royalties, source	350	295	Scientific Subroutine Package by Attest	295	269
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dBase single user DBMS by Rama	195	159	Stripes & Traps by Alpha Computer	70	59
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View Manager for C by Blaise	275	200	Pdsk Phoenix's new disk manager	195	148
Vitamin C by Creative Programming	150	129	Pro Pascal by Prospro, ISO Validated	390	345
Windows for C, Harvest Creative Software	195	149	RM/COBOL by Ryan-McIntosh	185	175
Windows for Data includes Windows for C	295	259	RM/COBOL, C, ANSI & BS COBOL	1250	995
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Senior Librarian
McGill University
Montreal, Quebec
Canada

WordStar understands many languages, but Chinese is not one of them. A Japanese/English version, called TwinStar, exists, but it is for the NEC 9800 (MicroPro International Corp., San Rafael, Calif.; (415) 499-1200; \$995). French, German, Italian, Portuguese, and Swedish WordStars for the IBM PC are sold by European subsidiaries of MicroPro.

The Chinese Character Generator (Eastern Computer, Virginia Beach, Va.; (804) 340-2496; \$495) is an expansion board with text processing software that will create Chinese ideograms on-screen.

Because a Chinese word processor must access thousands of ideograms, a dedicated system is the only practical tool (the Chinese government is developing one). By the way, a series of Oriental word processors, called the International Bilingual Word Processor, is available from Megachomp Co. (Philadelphia, Penn.; (215) 331-2748; \$59). Laotian, Cambodian, Thai, and Russian are among the languages included.

STARTING A MAINFRAME LINK

Can 2,400-baud synchronous modems be used to help an IBM PC emulate an IBM remote 3270 dial-up terminal in order to connect with an IBM VTAM mainframe? If yes, what additional hardware or software would be required?

Bill Lee
Edmonton, Alberta
Canada

Yes, the 2,400-baud synchronous modem can be used as one part of the connection, but the specific requirements of the mainframe configuration dictate the best way to connect with a PC. To access relatively small amounts of mainframe data, an async modem could be all you need; on-line services like Tymnet or CompuServe can be the intermediary. Larger downloads are practical using an async modem tied to a protocol converter. For more information see "Micro to Main-

frame: Making the Right Connection" (PC Magazine, Volume 5 Number 9).

WORD PROBLEMS SOLVED

I use Microsoft Word, and my screen has frozen while running ProKey. Do you know of a macro I can use with Word?

H. David Dean
Brooklyn, New York

These incompatibilities are all in the past. Changes made to Microsoft Word, Version 3.0, and ProKey, Version 4.0, resolved the last of the conflicts (which was a dispute over which program could use the gray Plus and Minus keys). There are a few copies of Version 4.0 that may still have this conflict; if you have one, call RoseSoft and ask for Revision 10.

HELP WITH MAINTENANCE

I want to start repairing my own computers. Are there any good books you can refer me to?

L. Carey
Birmingham, Alabama

■ WordStar understands many languages, but Chinese is not one of them. French, German, Italian, and Swedish versions are available.

The authoritative publisher of many car repair manuals, Chilton Book Company (Radnor, Penn.), publishes a comprehensive and extensively illustrated guide: How to Repair and Maintain Your IBM PC by Gene B. Williams (\$12.95).

ASK THE ADVISOR

Send questions about hardware and software choices you are facing to PC Advisor, PC Magazine, One Park Avenue, New York, NY 10016.



JUST RELEASED

Unleash the power of your LaserJet™

Mix any combination of fonts

Merge text and graphics from any program

Print extended and foreign language characters

Use all the printing features of your LaserJet with Polaris Ram-Resident PrintMerge

Ram-Resident PrintMerge gives you quick and easy access to all the LaserJet's printing features — no matter which word processing, database or LaserJet-compatible graphics program you're using. With a few simple commands, you can turn a bio-haz report into an exciting, visually appealing presentation. You'll be able to format text from virtually any program and combine it with the graphic output from any graphics program that can print on the LaserJet.

For instance, the chart on the left was created with Graphic Communications' Frontbase and Graphwriter. Ram-Resident PrintMerge even prints properly aligned tables made up of any combination of proportional fonts like the table on the right.



Region	Sales (Thousands)	Percent Gain
West	11,847	15.1%
Midwest	5,991	13.1%
South	7,116	16.2%
East	9,430	21.4%
Europe	1,242	8.8%
Far East	927	2.3%

* This is a made-up figure for this page.

You also get full access to all the formatting you've been missing with DisplayWrite 3, Multimate, etc. which include: selective use of any font, right justification of any combination of fonts, and a handy line and line drawing function. Plus, keyboard command screens give you instant access to the LaserJet's foreign language and special purpose characters. Here's a small sample of words you can type without hitting a tab:

Nones	E125	1047
u21	Prerogative	7A
Ratio	Munchies	(Over)

Be sure to ask about Polaris Crunch, a program used with Ram-Resident PrintMerge. Polaris Crunch automatically extracts files to save the LaserJet can handle. It also retains and sorts graphic images which allows you to print only the amount you want.

Read more about Ram-Resident PrintMerge below.

Justify any proportionally spaced text

Align tables printed with proportional fonts

Draw lines and boxes

Your software only lets you use a small fraction of the LaserJet's printing capabilities. Unfortunately, that also limits how precisely you communicate your message. That's why you need Polaris Ram-Resident PrintMerge.

It's the only program that puts you in direct control of all the LaserJet's printing capabilities—so you control what your document looks like, not the limitations of your software.

You'll be able to add graphics right in the middle of your text. Use all the LaserJet fonts and extended characters wherever you like. And print it all beautifully with Ram-Resident PrintMerge's justification and line-drawing abilities. What's more, Ram-Resident PrintMerge works with the software you're already using, so it's very easy to learn.

Since Ram-Resident PrintMerge lets you merge graphics from virtually any program that prints on the LaserJet, you can reinforce

complex ideas with illustrations right in the text. You can merge the graphic output or save a screen image, and merge either in one of four print resolutions. If your graphics are too large for your LaserJet to handle, try Polaris Crunch, a separate program that compresses, rotates and trims images.

With the help of Ram-Resident PrintMerge's useful formatting features, your document

Runs Directly From:

DisplayWrite 3
Multimate
Freelance
Lotus 123
Paradox
NewWord
R:base 5000
Map-Master
WordPerfect
Chart-Master

WordStar
Microsoft Word
Graphwriter
Javelin
WordStar 2000
Framework
Easy
Microsoft Chart
PC Crayon
Sign-Master

and more

will be as impressive as its contents. You'll be able to use LaserJet fonts in any combination for more attractive, readable text. And justify right-hand margins and align table columns printed with proportional fonts—even if they're downloaded from diskettes. For extra emphasis, use Ram-Resident PrintMerge's line and box drawing capabilities and the LaserJet PLUS patterns to highlight important ideas.

And when you need to use extended or foreign language characters, Ram-Resident PrintMerge's five keyboard translation screens will put them at your fingertips instantly.

But even with all these features, Ram-Resident PrintMerge is truly easy to use.

Timesaving printer setup screens store nine sets of page parameters. Simply enter parameters for Lotus, dBase, or any other application program once, and

use them again and again. "Ram-Resident" means it loads automatically when you boot your system, so it's always ready. Just use your software as you normally would. When you need Ram-Resident PrintMerge's special features, set up the printer with one of the nine setup screens or key in the simple print commands right in your document.

Put the rest of your LaserJet's printing power to work for you. Call these toll-free numbers to order your Ram-Resident PrintMerge. Versions are available for IBM-PC/100% compatibles. There's a 30-day money-back guarantee, so order now without risk.

\$149.

For ordering information call:

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1 (800) 338-5943

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San Marcos, CA 92069
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jc lips

The Word is Out...

It's going to break your heart if you already own a PC.

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JC LIPS provides a new experience in personal computing. Our third generation personal computer brings you technological advancement and features which have not been possible in the past. It runs all popular IBM PC software 2 to 4 times faster than other compatibles. It will impress you with unsurpassed performance and cool reliability. Best of all, it is available to you at an affordable price.

JC LIPS features the advanced-technology CMOS NEC V40 processor running at 8 MHz with an equivalent throughput of at least 9.5 MHz. The systemboard has 256K of RAM, expandable to 640K, a built-in floppy disk controller, a socket for a high speed floating point processor, and 8 I/O expansion slots. Also included as standard on systems are 360K floppy disk(s), a serial interface, a parallel printer interface, a battery backed-up clock, a keyboard, and a 135 Watt power supply, capable of handling all of this plus any accessories you may add later.

JC LIPS' display system includes a quality 14" high resolution monochrome monitor, with a dark

Starts from
\$795

background non-glare screen and a tilt and swivel base for easy viewing. The multi-function display card provides an IBM PC compatible interface for a monochrome display with Hercules compatible graphics or a RGB color graphics display.

JC LIPS is also available with high speed 20 MB hard disk with 2K cache buffer memory controller, Enhanced Color Graphics display adapter, high resolution RGB color monitor, local area networking controller, and more. These options can be added at any time, and with the features we supply as standard, it will be a difficult system to outgrow.

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Model 100 (100" x 100") is easy to use.

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User-Friendly

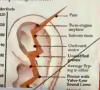
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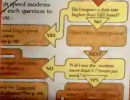
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HAUPPAUGE started earning a fast reputation with their 87 Math Pak, the combination of an 87 chip and 87 Software Pak that's been accelerating PC math since 1982.

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Now, Hauppauge Unveils the 287 FAST/10...

Our newest math coprocessor for the PC/AT, the 287 FAST/10 moves out at 10MHz—more than doubling the speed of each floating point math operation. The FAST/10 accelerates AutoCad, 1-2-3, Symphony, Turbo Pascal, Framework and more. The FAST/10 also runs in PC/AT compatibles including the Compaq Deskpro 286, Sperry PC/IT and most 286 accelerator boards.

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287 FAST/10 10MHz math coprocessor for PC/AT and compatibles...\$469

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87 Math Pak V.6.0 87 chip and math coprocessor software support for IBM BASIC Compiler 1.0, 2.0 and Microsoft's QuickBASIC. Plus, Matrix and FFT support, one year of free updates, complete source code and "8087 Applications and Programming".....\$279

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CIRCLE 276 ON READER SERVICE CARD

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PC
MAGAZINE

FIRST LOOKS

Dazzling Blue Z-181:
Most Usable Laptop

PC HANDS ON

BY PAUL SOMERSON

Your friendly IRS bought re-packaged Morrow Pivots. The free-spending U.S. Post Office purchased pricey Gridcases. Big-budget journalists took an instant liking to the Toshiba 1100+, while hordes of frugal fourth estaters pound away on Tandy Model 100s and 102s. And some die-hard IBM fan somewhere probably bought a Convertible.

Are they sorry now.

Zenith, which has quietly

been selling hundreds of thousands of workmanlike PC desktops to schools and government bureaucrats and which snagged the IRS contract (much to everyone's surprise, including Zenith's), recently introduced the first no-apologies, truly usable laptop. And if the Glenview, Ill., company, best known for TVs, can shave the machine's price and soup up its performance a bit, Zenith will have the market all to itself.

The Z-181 Portable Personal Computer leaves the competition in the weeds. Weighing in at just under 12 pounds, this



The \$2,399 Z-181's backlit supertwist LCD screen makes it the laptop that's easiest on the eyes.

trim beauty boasts a pair of speedy 3½-inch, 720K-byte pop-up shock-mounted disk drives, 640K bytes of no-parity RAM, a respectable 75-key keyboard with a diamond-shaped cursor pad, RGB output, a rechargeable NiCad battery, a built-in real-time clock, serial and parallel ports, a connector that lets you daisy-chain up to two external disk drives, and an optional 300/1,200-bit-per-second internal Hayes-compatible modem (\$399 extra).

But what makes the Z-181 such a clear winner is its astonishing screen. The shocking-blue-on-white, backlit supertwist LCD image is so bright, crisp, and rock-steady that it looks painted on. Most other LCD displays on the market sport squinty, squashed gray-on-gray output.

Zenith's large (10½-inch) display maintains the same as-

(continued on next page)

Six New Printers:
\$599 to \$1,945

PC HANDS ON

BY BRUCE BROWN

A look at six newly introduced printers clearly indicates that the trends of the last year continue: prices are coming down and print quality is improving. The following crop of new machines covers a variety of specific needs, from small but inexpensive to full featured but costly. All were subjected to the same tests used for the Project Printer reviews in this issue and last year's printer issue (*PC Magazine*, Volume 4 Number 19).

The Centronics PrintStation 220 is a small dot matrix printer

suitable for home or light office use; it produces reasonable quality print at moderate speeds.

Two emulation modes are standard: the Epson FX series and the IBM Graphics Printers. In IBM mode, the printer is graphics compatible with both the IBM 5152 Graphics Printer and the IBM Proprietary. The Epson mode yields graphics compatibility with the Epson MX-80, FX-80, and FX-85 printers. The PrintStation 220 passes our text-compatibility test for both the IBM Proprietary and the Epson MX-80.

Not terribly fast, the PrintStation 220 walked through our speed tests at a rate of 82 characters

per second in draft mode and 27 cps in its fine letter quality mode.

The PrintStation 220's standard tractor-feed mechanism is unusual in appearance: it's a rectangular box that attaches to the rear of the printer. In testing, the tractor worked fine.

Small and Lightweight

Small size and light weight are the PrintStation 220's best virtues, making it ideal as a shared printer that needs to be moved often.

The low-cost side of the dot matrix universe is crowded, but the Centronics PrintStation 220 is a simple, capable Epson/IBM-compatible machine with a better-than-average letter quality mode.

ALPS America keeps on coming back with more attention-getting dot matrix printers. The ALPS LQ300 and P2400C

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ZENITH Z-181

The quality is in 33

SIX NEW PRINTERS

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SMALLTALK/V

An object-oriented programming language that's a steal at \$99 51

THREE FINE MICE

A choice: optical or track-ball pointers 55

BREAKTHRU 206

Plug-in turbo-charger that caches ROM 59

Data General One: Two New Screens Are Easier To Read, but Is That Enough?

The Data General One made waves when it was introduced. It was small, sleek, had a true (2-to-1) screen aspect ratio and looked like it meant business—until it was turned on. Unfortunately, doing business with the DG One was a chore: display legibility was so abysmal that it rendered the machine virtually useless.

Data General went back to the drawing board to address the screen problem. Its newest offering, the Data General One/Model 2, is available with either an improved liquid crystal display (LCD) or an electroluminescent (EL) display. Additional options include two minifloppies or an internal 10-

megabyte hard disk drive.

Both of the new screens are tremendous improvements. The EL display, which measures 4.8 by 7.6 inches, has very bright yellow letters on a dark background and offers excellent legibility. It also adds \$1,000 to the portable's price tag.

The LCD display is slightly larger than the EL version (at 8.5 by 6.75 inches), with blue-green letters on a green background. The LCD is certainly readable and makes the machine usable, but I found myself wanting to adjust the screen contrast or brightness, neither of which is possible.

The screen changes are really the big news for the Model 2;

not much else has changed drastically (except the optional hard disk). The machine is still quite compact and portable (10.5 pounds for the LCD and 11.5 pounds for the EL) and showed no problems running any PC-compatible software. The Model 2 also gets good marks for being rugged and showing good overall construction quality.

If the Model 2 is to compete seriously with the best of the portables, however, there are still drawbacks that must be addressed.

The keyboard is unappealing, with smallish key caps and tight interkey spacing. The cursor keys are inconveniently arranged on a single row, and Page Up, Page Down, Home, and End can be accessed only by holding down a second (SPE-



The \$1,795 Data General One/Model 2 comes with a liquid crystal display or an optional electroluminescent screen.

CIAL) key at the same time.

The 80C88 microprocessor runs at a snail-like 4 MHz, and the 3½-inch disk drives are agonizingly slow.

The Model 2 still lacks the overall firepower to match its good looks. —Jon Pepper

ZENITH Z-181

(continued from preceding page)

pect ratio as a standard monitor, giving you true pie charts rather than flattened watermelon charts. And it displays such sharp, readable text and graphics that it nearly rivals a CRT.

You can tilt the screen comfortably through an arc of 150°, and the entire image is readable from a wide range of angles. (Users of other LCDs have to adjust the screen or move their heads to jump from the top to the bottom.) And the display is equally impressive under all lighting conditions.

While it's clearly at the head of its class, the Z-181 could use some help. Its Ctrl key is located too far to the left, in a thicket of shift keys, and right above the Fn key. Fn-ScrollLock triggers a print screen, and it's too easy when groping for a frantic Ctrl-ScrollLock break attempt to trigger Fn-ScrollLock by mistake and lock up the system.

The CPU is a CMOS 8088 running at a paltry 4.77 MHz; Zenith should have installed a higher-performance chip or turned up the clock. And a hard disk would make life easier. Zenith admits both improvements are in the works.

While you can nurse the machine along on a single charge for 5 hours if you don't spin the disks much and keep the brightness setting low (the screen automatically dims after a few idle minutes), adding the optional modem and 8087 math coprocessor can slant you down in as little as an hour.

Zenith offers an optional standalone battery recharger, but the budgeonlike packs are real luggage ballast and should have been encased in snap-in modules. You can use the system while you're plugged into the wall recharging the battery.

Another gripe is that the low-

power warning LED is adjacent to the drive lights; if you're not paying attention you can miss the signal or confuse it with disk activity. It flickers on when you're down to your last 3 minutes of juice; it would be better to beep an alarm.

And one final complaint—why can't computer companies hire decent manual writers? The skimpy little 36-page owners manual was filled with such helpful tips as "Do not immerse this computer in water." And while it explains in breathless detail such arcana as how the firmware debugger interprets the flag bits in the FL



Zenith Z-181 and Data General One/Model 2 vs. the IBM PC-XT

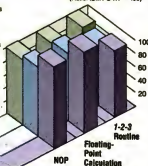
The Zenith Z-181 made an excellent showing, holding its own with the 8088-based XT on tests of the computers' processors. The Z-181 beats the desktop computer on the 1-2-3 Routine, indicating fast screen-writing. The Data General laptop may be easy on the eyes, but it's slow with calculations.

The 128K NOP benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

The Floating-Point Calculation benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentials, and logarithmic and trigonometric functions. This test program uses the floating-point library included with Microsoft C Compiler 3.0.

Designed for a 256K environment, the 1-2-3 Routine benchmark test assesses the computational speed and RAM-management capabilities of the machines by using a 1-2-3 macro that performs a series of both global and individual worksheet tasks. The macro copies and recalculates a 10-cell range 49 times, moves 100 cells, deletes 100 cells, and then systematically clears the spreadsheet.

Normalized results
(Ratio: IBM PC-XT = 100)



Performance Times

(Times are in seconds and decimal seconds.)

Product	NOP	Floating-Point Calculation	1-2-3 Routine
IBM PC-XT	10.11	155.32	60.00
Zenith Z-181	10.60	160.99	55.00
Data General One/Model 2	12.52	190.02	60.00

PC FACT FILE

Data General One/Model 2

Data General Corp.
4400 Computer Dr.
Westboro, MA 01580
(617) 366-8911

List Price: Model 2-LCD with one 3½-inch drive and 256K RAM, \$1,795; with serial/parallel ports and battery and charger, \$1,995; EL screen option, \$1,000 extra; 10-Mbyte drive, \$1,000; 256K RAM card, \$390; 1,200/300-bps modem, \$450; color adapter card, \$325.

In Short: Rugged portable with a good display. Suffers from slow CPU and a poor keyboard.

CIRCLE 647 ON READER SERVICE CARD

register, it doesn't even hint at how to set the internal clock. Give users a break.

However, if you've been thinking about whether to buy a laptop, Zenith just made up your mind for you. Nothing else even comes close.

PC FACT FILE

Z-181 Portable PC
Zenith Data Systems
1000 Milwaukee Ave.
Glenview, IL 60025
(800) 842-9000

List Price: \$2,399, with 640K, two shock-mounted retractable 3½-inch 720K floppy disk drives, parallel/serial ports, RGB output, power-supply/battery recharger, NiCad battery, clock/calendar, external drive connector, firmware diagnostics, and debugger.

In Short: Everything that a laptop user could want (except a faster processor and a hard disk) in a stylish, 12-pound box. The most awesome, drop-dead support LCD screen on any portable, a decent keyboard, and fast twin pop-up disk drives make this portable a runaway winner.

CIRCLE 648 ON READER SERVICE CARD

Printers

(continued from page 33)

are both wide-carriage printers with front-panel menu-driven function control, IBM and Epson emulation, beautiful letter quality print, and the ability to print in color using Epson JX-80

command codes. Both also offer the option of using either an 18- or 24-pin printhead (the extra pins will set you back \$100).

To get a sense of the available range, we evaluated an LQ300 with an 18-pin printhead and a P2400C with a 24-pin printhead.

Push Me/Pull You Tractor

One of the key differences between the two printers is that the LQ300 prints the IBM high-order character set; the P2400C does not. The LQ300 does not have a standard tractor (a bidirectional tractor-feed mechanism).

(continued on page 36)



Clockwise, from top left, are the \$599 PrintStation 220, the \$799 QuietSet Plus, the \$895 ALPS LQ300, the \$1,295 ALPS P2400C, the \$1,295 Prowriter C-715 Reliable, and the \$1,545 AMT Office Printer.

Printer Accessories: Saving Space and Paper

Dot matrix printer stands in the past have been works of art in smoke-colored plexiglass or oak. If all you want is cheap and reliable, the best of the bunch is also the cheapest: the \$19.95 Universal Printer Stand from Curtis Manufacturing Co.

The stand is but five pieces of molded beige plastic and a pair of nuts and bolts. Sounds simple, is simple, and works great. The legs and removable rear printout tray adjust to fit standard or wide-carriage printers. A 45-pound NEC Spinwriter or behemoth-grade Okidata 2410 might be too much, but anything lighter works just fine.

Wizard Stacker

Somewhat more complex are the Wizard Stand and the Wizard

and Auto-Stack paper stacker. Anyone with a mechanical engineering degree from Cal Tech should have no trouble putting this contraption together (especially the three clear-plastic paper guides, which look remarkably like each other but aren't) and adjusting tolerances so printouts don't jam and tear.

Once it's working, the stand and stacker make a great conversation piece and do an excellent job guiding and folding printouts. Because you waste two or three sheets every time you tear off paper, the Wizard units are best for long jobs.

If your office is cramped for space, the Wizard units may be the only choice among printer stand/stackers. The stacker unit fits over, not behind, the printer.

er. If your printer fits, the stacker will, too. —Bill Howard

PC FACT FILE

Universal Printer Stand
Curtis Manufacturing Co.
305 Union St.
Peterborough, NH 03458
(603) 924-3823

List Price: \$19.95

In Short: A functional and cheap—very cheap—printer stand and paper catcher, adjustable for standard or wide-carriage printers.

CIRCLE 626 ON READER SERVICE CARD

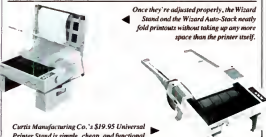
Wizard Stand

Wizard Auto-Stack
Wizard Computer Accessories
P.O. Box 1867
Greenville, SC 29602
(803) 244-4110

List Price: Wizard Stand, \$34.95; Wizard Auto-Stack, \$49.95; both units, \$79.95.

In Short: A Rube Goldberg-looking contraption that works well once it's fine-tuned to keep the paper from jamming.

CIRCLE 625 ON READER SERVICE CARD



Curtis Manufacturing Co.'s \$19.95 Universal Printer Stand is simple, cheap, and functional.

Printers

(continued from page 35)

nism is an \$85 option), while the P2400C includes the same terrific dual-mode "push me/pull you" tractor used on the ALPS P2000 and P2100.

The Fast P2400C

The P2400C is the faster of the two printers; in draft-mode testing, the P2400C printed at 150 cps and the LQ300 at 108 cps. In letter quality or double-strike mode, both machines maintained about the same rate: 73 and 72 cps for the P2400C and the LQ300, respectively.

The P2400C has square, black front-panel switches, while the LQ300 has a more-modern-looking blue panel with small white capsule-shaped switches. While the control panels look different, their method of operation is the same, allowing the user to print the current printer parameter settings and to select new settings via the front-panel switches without ever having to play with irksome DIP switches. Power-on defaults can be changed via the control panel.

The ALPS LQ300 and P2400C are both rugged wide-carriage dot matrix printers with excellent letter quality and middling-to-good speed. If you need a color printer as well as a dot matrix workhorse, consider these two units. If black and white is all you need, the P2000 is the better choice.

HP QuietJet Plus

The Hewlett-Packard QuietJet Plus is a small, mercifully quiet ink-jet printer. Like most ink-jet printers, it requires clay-coated paper to produce clear type. The special paper is an added expense that dissuades many from using ink-jet printers at all.

At \$799, the QuietJet Plus is not cheap but prints both high- and low-order IBM character sets; produces very nice letter quality type (on the special paper); and is text-compatible with the Epson MX-80, the IBM Proprinter, and the HP Laserjet printers. In graphics mode, the QuietJet Plus emulates the HP Laserjet, the IBM 5152 Graph-

ics Printer and Proprinter, and the Epson MX-80, FX-80, and FX-85 printers.

At 89 cps in draft mode and 33 cps in letter quality, the QuietJet Plus is fairly slow for its price bracket, but the relative slowness is compensated for by its hushed operation.

Weighing less than 10 pounds, the QuietJet Plus offers enough versatility and sufficient print quality to make it a perfect printer for use when traveling, especially if there's a Laserjet or one of the other compatible printers in the office.

Prowriter C-715 Reliant

In addition to its standard IBM Proprinter and Epson MX-80 text and Epson FX-80, FX-85, LQ-1000, and LQ-1500 graphics compatibility, the C-715 Reliant uses a new scheme for defining the printer's personality. While other printers use chips, cartridges, or interface modules to tell the unit how to emulate other printers or generate special fonts, the C-715 Reliant uses credit card-size plastic pieces that slip into the side of the printer.

The C-715 Reliant comes standard with Epson emulation, but cards for the IBM Proprinter, Toshiba printers, and the Diablo 630 will soon be available.

The C-715 Reliant prints 10 characters per inch in draft mode at 138 characters per second and in NLQ mode at 64 cps. The letter quality type competes with the best I've ever seen produced by dot matrix printers at a competitive price of \$1,295.

C-715 has a history of building sturdy, high-quality printers; the C-715 Reliant lives up to that reputation.

AMT Office Printer

The AMT Office Printer is a bit pricey at \$1,845 (with a choice of either a parallel or serial interface; \$100 more with both), but for the price you get a printer that offers you many features, several available peripherals, and many expansion options.

The AMT Office Printer is a 16-pin dot matrix printer, with color availability. We tested the

Diablo 630 configuration and found it was up to snuff; other emulations include the Diablo

C-150 Ink Jet, the IBM 5182 Color Printer, the Qume Sprint

(continued on page 56)



FACT FILE

ALPS LQ300

ALPS America Inc.
3553 North St.
San Jose, CA 95134
(800) 828-ALPS
(408) 946-6000
List Price: 18-pin pinhead model, \$895; 24-pin pinhead, \$995.

Dimensions: 5" x 24.1" x 15.8 in.
Weight: 37.5 lbs.
Made in Japan

In Short: An IBM-compatible, wide-carriage dot matrix color printer that produces very fine near-letter-quality type.

CIRCLE 440 ON READER SERVICE CARD

ALPS P2400C

ALPS America Inc.
3553 North St.
San Jose, CA 95134
(800) 828-ALPS
(408) 946-6000
List Price: 18-pin pinhead model, \$1,295; 24-pin pinhead, \$1,395.

Dimensions: 7.09" x 25.4" x 17.7 in.
Weight: 43.7 lbs.
Made in Japan

In Short: A continuation of the design used in the P2000 and P2100, the P2400C is a wide-carriage dot matrix printer with Epson compatibility.

CIRCLE 441 ON READER SERVICE CARD

QuietJet Plus

Hewlett-Packard Co.
3000 Hanover St.
Palo Alto, CA 94304
(415) 857-8000
List Price: \$799
Dimensions: 4.7" x 20.75" x 8.4 in.

Weight: 4.7 lbs.
Made in Japan

In Short: The HP QuietJet Plus is an ink-jet printer that's suited for travel or for those who demand low-priced HP Laserjet text and graphics emulation.

CIRCLE 442 ON READER SERVICE CARD

Prowriter C-715 Reliant

C. Itoh Digital Products Inc.
19750 S. Vermont Ave., #220
Torrance, CA 90502
(213) 327-5939
List Price: \$1,295

Dimensions: 5.2" x 24.9" x 14.7 in.

Weight: 37.5 lbs.
Made in Japan

In Short: The credit card-like printer identity and font cards offer an easy way to change the personality of this wide-carriage dot matrix color printer.

CIRCLE 443 ON READER SERVICE CARD

PrintStation 220

Centronics Data
Computer Corp.
1 Wall St.
Hudson, NH 03051
(603) 883-0111
List Price: \$599

Dimensions: 3.1" x 19.3" x 9.4 in.

Weight: 13.6 lbs.
Made in Japan

In Short: A simple, capable Epson/IBM-compatible dot matrix printer with moderate speed and a good letter quality mode.

CIRCLE 444 ON READER SERVICE CARD

AMT Office Printer

Advanced Matrix Tech. Inc.
1157 Toumaline Dr.
Newbury Park, CA 91320
(805) 499-8741

List Price: \$1,945 with both serial and parallel interfaces; \$1,845 with either serial or parallel.

Dimensions: 7.2" x 25" x 18.5 in.
Weight: 45 lbs.

Made in Singapore

In Short: The AMT Office Printer, available in several configurations with many standard features and options, is truly a power user's dot matrix color machine, as well as a potential office workhorse. The AMT produces beautiful type.

CIRCLE 445 ON READER SERVICE CARD

One Year Anniversary
over 12,000 networks installed
Anniversary Sale!
10% discount on all orders thru 12/31/86
Credit card or C.O.D. only

EasyLAN—Networking For Less Than \$100 Per PC

STOP buying expensive duplicate PC peripherals. Usually your peripherals just sit idle. If your office owns two or more PCs can you justify costly laser printers for each PC? How often are your printers actually busy? Thirty minutes a day? An hour a day? Even your expensive hard disks are used infrequently.

The obvious solution to avoid expensive duplicate peripherals is a local area network that allows you to share printer and disk drives. But until now LANs have cost in excess of \$1,000 per PC.

The EasyLAN™ OFFICE NETWORK

EasyLAN shares printers and disk drives between IBM PCs. EasyLAN can save you \$1,000 or more per PC by eliminating duplicate equipment purchases.

EASYLAN HIGHLIGHTS

- EasyLAN shares printers, plotters, data, and disk storage
- PC to PC file transfer
- Print spooling
- New PBX support
- Easy to install
- Easy to operate
- Modern support
- Performs in the background

EasyLAN's low price matches the small business user's cost-sensitive budget. It is the office network solution for less than \$100 per PC including cables and software for a 2 PC or 3 PC network.

EasyLAN performs its operations concurrently in the background. EasyLAN communications, file transfers and printer operations all take place while each PC simultaneously performs such normal DOS applications as Lotus 1-2-3™ WordStar™ and dBASE™.

NEW PBX SUPPORT

New PBX support allows EasyLAN to transfer data files and share peripherals between PCs using PBX circuit-switched connections and twisted pair wiring. EasyLAN has already been installed on a number of different PBX systems and has been certified by Northern Telecom on the Meridian SL-1.

EasyLAN's performance meets your small office or department requirements to move word processing documents and spread sheets between PCs. For example, EasyLAN can transfer a 10-page document between PCs as a background operation, in less than one minute.

EasyLAN loads automatically at boot time. It manages the PC's serial and parallel ports for communications and printing.

"The value is high. 

—InfoWorld Report Card

Printer sharing operates transparently with existing programs. Print files are automatically spooled to disk and scheduled for printing. Multiple printers per PC may be designated for specific office tasks.

"I bought access to a laser jet printer for \$80."

—CONOCO Oil User

Disk sharing uses EasyLAN's EZCOPY command to move files to and from PCs. ASCII or binary files can be transferred in the foreground, or in the background while other DOS programs run.

All communication operations are protected by a unique password assigned to each PC so security is maintained.



EasyLAN Office Network

EASYLAN SPECIFICATIONS

Each PC in the network requires an individual licensed copy of the EasyLAN program and takes 30k of memory on each satellite PC, a serial port, and DOS 2.0 or above. EasyLAN disks are not copy protected. The HUB PC requires a serial port for each satellite PC. The COM2 and COM6 boards are serial port expansion boards which permit you to add serial ports to the HUB PC.

EASY TO INSTALL

EasyLAN can be installed in less time than it takes to enjoy your coffee break. Just plug the EasyLAN cables into existing serial ports. The EasyLAN Network Configuration Program provides a menu driven installation program that will guide you step-by-step through the software installation process.

EASY TO ORDER

EasyLAN is a proven product with over 12,000 installations. To order just call toll free 800/835-1515. Start with a two PC network and expand as your needs demand.

"If it does all you need why spend more? It is the ultimate example of practicality in a local area network."

—PC Magazine

PRODUCT SUPPORT

We take pride in our quality product support. EasyLAN support is provided over the telephone by the same people who installed over 12,000 networks last year.

"I look for products that make my job easier and save my company money. EasyLAN does both."

—Mini Micro Magazine

EasyLAN

ORDER TODAY 1-800-835-1515 in CA 408/738-8377



EasyLAN Order Form

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In CA 408/738-8377

For Configuration Assistance & Technical Questions

Call 408/738-8377

**Place your Order Immediately
Dealer Inquiries
Invited**

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Telephone (____) _____
Payment: Visa, MasterCard, Check, C.O.D., Bank Draft
Name on Credit Card _____
Cr. Card No. _____ Exp Date ____/____/____

Item	Description	Price	Qty	Amount
EL 01	EasyLAN Kit— for 2 PCs 30' cable, two disks & manuals	\$179.95	_____	\$ _____
EL 02	EasyLAN Expansion Kit—for 1 PC 30' cable, one disk & manual	\$109.95	_____	\$ _____
EL 11	EasyLAN disk & manual (39¢ disk \$89.95)	\$ 79.95	_____	\$ _____
EL 12	EasyLAN 30' cable	\$ 49.95	_____	\$ _____
EL 13	COM2 serial port expansion board, two ports	\$219.95	_____	\$ _____
EL 14	COM6 serial port expansion board, six ports	\$489.95	_____	\$ _____
EL 15	Custom length cables, call for quote		_____	\$ _____

CA res add applicable sales tax \$ _____

Shipping charge USA \$10.00, \$ _____

other \$30.00

TOTAL ORDER \$ _____

Server Technology, Inc., 1095 East Duane Ave. #103
Sunnyvale, CA 94086 Telex 5106003451

Disk-Maker Tandon Drives PCA into AT-Class Market

PC HANDSON

BY WINN L. ROSCH

With the PCA, noted disk drive maker Tandon Corp. hopes to profit from buyers' apprehensions about off-brands, house-brands, and mail-order machines by selling a top-quality machine backed by a known brand name. And the price might even send the Big Blue marketing department back to their spreadsheets.

Nothing is sacrificed in the \$2,195 Tandon PCA. While not a carbon copy of the IBM PC AT, the PCA is functionally equivalent to it. With an 80286 microprocessor, an optional 80287 coprocessor, and keyboard-selectable clock speeds of 6 and 8 MHz, it offers comparable performance.

A 1.2-megabyte high-density floppy disk drive is standard. The machine we evaluated also included Tandon's 40-megabyte, high-performance internal hard disk, a \$1,200 option. A 20-megabyte Tandon hard disk option goes for \$400.

When the 40-megabyte drive is set up under MS-DOS 3.1 (re-

vision 3), which is included with the PCA along with GW-BASIC, the default configuration permits the entire disk capacity to be accessed as one DOS device. To sidestep the 32-megabyte-per-disk DOS limit, Tandon formats the big disk with 1,024-byte sectors instead of standard 512-byte sectors. Because each disk-allocation unit still consists of four sectors and requires 4,096 bytes, the big drive will use more space to store small files than would a 512-byte sector drive.

The PCA system board has eight expansion slots, including six with the AT-style 16-bit bus and two 8-bit slots. The right-most slot is filled with a made-in-Ireland combined floppy/hard disk controller that uses the Western Digital chip set. In the evaluation machine, the two 8-bit slots were filled with a Tandon \$90 dual video option board, which drives either a TTL monochrome, RGB color, or composite monitor and a \$90 parallel/serial interface adapter, which is similar to the one included on enhanced models of the IBM AT.

Standard memory is 512K

bytes in two parity-checked banks of 256K-bit chips soldered to the system board. Two banks of sockets are provided for on-board memory expansion. The sockets can be filled with either 64K-bit chips to give 640K bytes of DOS memory, or with 256K-bit chips to yield either 512K bytes for DOS and 512K bytes of expanded memory or 640K bytes for DOS and the rest wasted. Using memory expansion boards, the PCA can handle up to 16 megabytes of expanded RAM.

The Tandon keyboard uses the original AT keyboard layout with the large Enter key, no dedicated cursor pad, and Esc in the upper-right-hand corner. This is the only part of the PCA that is less than satisfactory. Its linear-travel, hard-contact keys offer little tactile feedback, give no IBM-style audible feedback, and are not uniformly sensitive.

The PCA BIOS firmware bears a Tandon copyright. No compatibility problems were found with any of a range of test software, including *I-2-3*.

System performance differs little from that of an 8-MHz AT.

PC FACT FILE

Tandon PCA

Tandon Corp.

20450 Plummer St.

Chatsworth, CA 91311

(800) 556-1234

(800) 441-2345 (in Calif.)

List Price: Base unit, including

512K RAM, 1.2-Mbyte floppy

disk drive, keyboard, MS-

DOS, BASIC, \$2,195; amber

monitor, \$190; color and mono-

chrome graphics adapter, \$90;

PCA-20 with 20-Mbyte hard

disk, \$2,595; PCA-40 with 40-

Mbyte hard disk, \$3,395.

Requires: Monitor, adapter.

In Short: A desktop computer

that's equivalent to the 8-MHz

IBM PC AT. Only the keyboard

is substandard.

CIRCLE 427 ON READER SERVICE CARD

On some functions, the Tandon earns a slight edge because of its speedier hard disk drive, which is capable of a 26-millisecond average access time.

The PCA is a good choice for anyone who needs the security of a brand name and nearby dealer service (Tandon has developed a network of dealers for the PCA). It offers near-identical performance to an IBM PC AT, high-quality workmanship, and a good price. Overall, the PCA is a good value.



Benchmark Tests: Tandon PCA vs IBM PC-XT Model 286 and the 8-MHz IBM PC AT

The PCA's similarities to the 8-MHz AT hold up under benchmark testing. In the one test where the PCA clearly beats the AT—the *I-2-3* routine—the differences are probably attributable to the PCA driving a monochrome screen, while the AT is running an EGA.

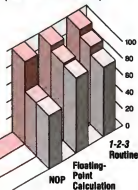
The 128K NOP benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

The Floating-Point Calculations benchmark test measures processor speed by leaving through a series of floating-point calculations, including multiplication, division, exponentials, and logarithmic and trigonometric functions. The test program

uses the floating-point library included with Microsoft C 3.0.

The *I-2-3* Routine benchmark test for spreadsheet applications, designed for a 640K environment, assesses the computational speed and RAM management capabilities of the machine by using a *I-2-3* macro that performs a series of both global and individual worksheet tasks. The macro copies and recalculates a 10-cell range 495 times, moves 1,000 cells, deletes 1,000 cells, and then systematically clears the spreadsheet.

Normalized results (Ratio: IBM PC XT = 100)



Performance Times

(Times are in seconds and decimal seconds.)

	NOP	Floating-Point Calculation	I-2-3 Routine
IBM PC-XT Model 286	5.55	36.97	78.00
8-MHz IBM PC AT	4.17	34.41	73.81
Tandon PCA	4.17	34.33	65.29

Maynard Has A Little Surprise For IBM PC Users.

Surprise,TM Maynard's new high-speed board increases your IBM PC's* speed up to 2½ times, and doesn't take up an expansion slot!



"I just calculated my Lotus spreadsheet in a fraction of the time it used to take! Maynard's new Surprise is fast!"



"I installed Maynard's Surprise even though I didn't have any expansion slots left! Was I surprised! Now my PC's faster than ever!"

*IBM PC and XT are trademarks of International Business Machines. Compaq is a trademark of Compaq Computer Corporation. NCR is a trademark of NCR Corporation. Prices for Compaq and NCR Model 4 are slightly higher.



"Maynard's Surprise jumps the PC's speed to 2.6 on the Norton SI scale! That's over 2½ times its normal speed!"

just

\$249!

suggested
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- increases PC speed up to 2½ times!
- doesn't use an expansion slot!
- installs in seconds!
- works with the IBM PC and XT, Compaq, and NCR Model 4!
- surprisingly low cost!



Available at the finest computer stores.

CIRCLE 478 ON READER SERVICE CARD



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Shaping tomorrow's technology.

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■ NEW ON THE MARKET ■ PAUL M. STAFFORD

Software Publishing Co. introduces Harvard Professional Publisher

More desktop publishing power is available from **Software Publishing Co.**, maker of the **PFS:** and **Harvard** software lines. Its \$695 **Harvard Professional Publisher** is a full-featured page-layout package that can import text files in ASCII or DCA format, charts from **Harvard Presentation Graphics** and **1-2-3**, and images from **PC Paintbrush**, **Dr. HALO**, and **Microsoft Windows Paint**.

The **Harvard Professional Publisher** supports EGA and Hercules graphics adapters and can output to the HP LaserJet, the Apple LaserWriter, and any laser printer that implements Adobe Systems' PostScript page-description language.

List Price: *Harvard Professional Publisher*, \$695. **Requires:** 640K RAM, Hercules or EGA graphics adapter (mouse and laser printer recommended). **Software Publishing Co.**, 1901 Landings Dr., P.O. Box 7210, Mountain View, CA 94039-7210; (415) 962-8910.

CIRCLE 431 ON READER SERVICE CARD

General Parametrics' High-Resolution Slide-Production System Costs \$5,995

Producing high-resolution, quality images for presentation has always had its price—usually between about \$11,000 and \$29,000. **General Parametrics Corp.**'s \$5,995 **PhotoMetric 200** is a 2,000- by 2,000-pixel resolution, 1,000-color film recorder that rivals high-end digital recorders costing at least twice as much.

The system works with programs such as **1-2-3**, **Freelance**, **Microsoft Chart**, and **Chart Master**. The system comes complete with the **PhotoMetric 200** PC Board, which enables a conventional color monitor to display 1,000 colors (as opposed to the 4 or 16 you are used to), and also simulates a 2,048- by 2,048-pixel resolution, allowing users to view the actual image in its true colors and simulated resolution before recording it permanently.

Images are recorded onto 35mm slides; the recording process uses automatic exposure calibration, and so it requires no end user adjustment.

VideoShow 160 owners may

upgrade their systems to support the new camera through an option called the **PhotoMetric 200VS**, which retails for \$4,195. This system includes the **PhotoMetric PC Board**, a 35mm camera, and **PhotoMet-**

ric **VS** software.

List Price: *PhotoMetric 200*, \$5,995. **General Parametrics Corp.**, 1250 Ninth St., Berkeley, CA 94710; (415) 524-3950.

CIRCLE 434 ON READER SERVICE CARD

HOT PROSPECT

PC-Based Publishing Advances: PageMaker for PCs, MDS Genius Display

There's a juggernaut on the horizon. Its name is desktop publishing, and now PC users have a program and a display with which to master it.

Aldus Corp.'s **PageMaker**, beloved of Macintosh users, is making its way into the PC world in the form of the \$695 **PageMaker for the PC**. **PageMaker for the PC** includes functions found in the Mac version and adds more. It offers automatic dictionary-based hyphenation and kerning and can work on facing pages at the same time and with documents up to 128 pages in length.

PageMaker for the PC works under the **Microsoft Windows** applications environment, and so it supports a wide range of graphics and output devices. It imports preformatted files from **Microsoft Word**, **WordPerfect**, **WordStar** (Version 3.3), **MultiMate**, **xyWrite III**, and **Microsoft Windows Write**, in addition to ASCII text files and DCA-format files.

Micro Display Systems' \$1,795 **The Genius** graphics display adapter and monitor

Micro Display Systems' \$1,795 **The Genius** is a 728- by 1,008-pixel black-and-white monochrome display system targeted at desktop publishing applications.

combination is not yet supported by **Windows**, so you can't run **PageMaker for the PC** on it. But you can use it with **Megahaus's InPrint** and, most likely, future desktop publishing software, and all in 728-dot by 1,008-line black-and-white monochrome resolution. The **Genius's** screen can display a full 8½- by 11-inch page on its 15-inch (diagonal) screen.

List Price: *PageMaker for the PC*, \$695. **Requires:** 512K RAM, PC AT or compatible, hard disk drive, **Microsoft Windows**, mouse, DOS 3.0 or later. **Aldus Corp.**, 411 First Ave. South, #200, Seattle, WA 98104; (206) 622-5500.

CIRCLE 438 ON READER SERVICE CARD

List Price: *The Genius* display adapter and monitor, \$1,795. **Micro Display Systems Inc.**, 1310 Vermillion St., Hastings, MN 55033; (800) 328-9524; (612) 437-2233.

CIRCLE 439 ON READER SERVICE CARD



Pizazz Color Print Utility Supports EGA On 100 Color Printers

None of the color dot matrix printers appearing on the market will reach their full potential unless you have software that supports them. **Application Techniques'** **Pizazz** is a \$49.95 color-print utility that lets you print from a palette of over 200 colors on any of over 100 printer models. The package also features 30 different monochrome print shades, making it useful

Corvus Unveils 386-Based File Servers, Workstation For Local Area Networks

Corvus Systems is shipping its Series 386 products line, which consists of a \$12,795 AT-compatible **High Performance Workstation** and 70- and 126-megabyte **File Servers** (\$16,595 and \$19,795, respectively) for Novell-compatible local area networks (LANs). All three units are based around the 16-MHz 80386 CPU.

The **High Performance Workstation** includes 512K bytes of 32-bit RAM, a 70-megabyte hard disk rated for a 40-millisecond average access time, and a 1.2-megabyte floppy disk drive. The **File Servers** also include 2 megabytes of 16-bit RAM, monochrome monitors, Hercules-compatible monochrome/graphics cards,

Softway, Diiolect Debut Development Systems For Making Windowed Screens

Two screen generators have appeared on the market.

Softway's \$129 **High Screen** allows program developers using any language to create screens that are called from a single line of their program's code. **High Screen** has a full-



Besides enhancing color dot matrix printouts, Applications Techniques' \$49.95 Pizazz enhances single-color printouts by providing 30 possible shades of gray tone.

for single-color printers as well. Pizazz loads and stays memory resident, activating at the touch of the Shift-Print keys, and menus give you total control over the appearance of your output.

List Price: Pizazz, \$49.95.

Requires: 90K RAM, DOS 2.0 or later. Application Techniques, 10 Lomar Park Dr., Pepperell, MA 01463; (617) 433-5201.

CIRCLE 436 ON READER SERVICE CARD

Citicorp's Streetsense: On-line Real-Time Stock Market Transaction Data

For only \$475 a month, stockbrokers and major market players can have access to real-time quotes and trades from NYSE, AMEX, NASDAQ OTC, and all domestic and regional stock exchanges through Streetsense, Citicorp's on-line investment management service.

Streetsense presents information in window format, the size and on-screen location of which are user-adjustable. Users can download Streetsense data to ASCII files.

List Price: Streetsense, \$475 per month. **Requires:** 320K RAM (512K recommended), modem. Citicorp Investment Bank, 641 Lexington Ave., Seventh floor, New York, NY 10043; (800) 241-2476.

CIRCLE 437 ON READER SERVICE CARD

Maynard, Digital Storage Systems Offer 60-Megabyte Tape-Backup Systems



Digital Storage Systems' \$2,600 ARC 9000 is a 60-megabyte tape backup drive that makes continuous backups as data is written to disk.

Two companies are offering 60-megabyte tape-backup systems with unique capabilities: one uses cassettes and the other uses streaming tape.

Maynard Electronics' MaynStream 60 retails for \$1,195 for an internal unit and \$1,595 for an external subsystem. Employing 60-megabyte 1/4-inch cassettes, Maynard claims file-by-file backup speeds of under 3 minutes for 10 megabytes. The MaynStream 60 can read cassettes from the MaynStream 20 line, and the MaynStream 20 can also read cassettes from the 60 with up to 20 megabytes of data on them.

Digital Storage Systems' \$2,600 ARC 9000 is a 60-megabyte streaming-tape unit that operates automatically to back

up all data as it is written to disk, making backup completely transparent. All file transactions are time- and date-stamped to facilitate data-logging and audit-trail; file restoration can be sorted by time, date, filename, or subdirectory, or complete disk restorations can be made.

List Price: MaynStream 60, internal version, \$1,195; external subsystem, \$1,595. Maynard Electronics, 460 Semoran Blvd., Casselberry, FL 32707; (305) 331-6402.

CIRCLE 438 ON READER SERVICE CARD

List Price: ARC 9000, \$2,600. Digital Storage Systems Inc., 1234 Sherman Dr., Longmont, CO 80501; (303) 651-6312.

CIRCLE 439 ON READER SERVICE CARD



Corvus's Series 386 line includes the \$12,795 High Performance Workstation, and \$16,595 and \$19,795 File Servers.

60-megabyte streaming-tape drives, and Novell's NetWare 2.0a LAN operating system.

List Price: High Performance Workstation, \$12,795; 70-Mbyte File Server, \$16,595; 126-Mbyte

File Server, \$19,795. Corvus Systems Inc., 2100 Corvus Dr., San Jose, CA 95124; (408) 559-7000.

CIRCLE 430 ON READER SERVICE CARD

page screen editor, is royalty free, and non-copy-protected.

Dialectic Systems' \$195 SoftScreen/HELP is a combination screen editor/run-time facility that helps developers to design integrated help screens into their programs.

List Price: High Screen, \$129. **Requires:** 256K RAM, DOS 2.0 or later. Softway Inc., 500 Sutter St.,

#222, San Francisco, CA 94102; (415) 397-4666.

CIRCLE 438 ON READER SERVICE CARD

List Price: SoftScreen/Help, \$195. **Requires:** 256K RAM, DOS 2.0 or later. Dialectic Systems Inc., 1930 E. Marlton Pike, Cherry Hill, NJ 08003-2148; (609) 424-0140.

CIRCLE 439 ON READER SERVICE CARD

AST's 300-dpi TurboScan Intended for Graphics, Publishing Applications

As part of its continuing effort to expand into the burgeoning PC-based page-layout market, AST Research has announced its \$2,395 TurboScan scanner.

Scanning at a resolution of 300 dots per inch, the TurboScan's brightness and contrast controls are adjustable in 14 steps, and scaling is adjustable in 16 steps from 25 to 100 percent. The unit scans in three modes: straight black and white, black-and-white gray

scales, and mixed.

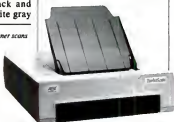
Included with the TurboScan is a program called *I-Star*, which interfaces the scanner with WordStar, PC-Paint, PC-Paintbrush, IPrint, Ready-Set-Go, GEM Paint, PageMaker, Ventura Publisher, and Dr. HALO II.

List Price: TurboScan, \$2,395.

AST Research Inc., 2121 Alton Ave., Irvine, CA 92714; (714) 863-1333.

CIRCLE 436 ON READER SERVICE CARD

AST's \$2,395 TurboScan scanner scans at a resolution of 300 dots per inch and can mix straight black-and-white and gray-scale images in the same scan. The TurboScan can also interface with many popular programs.



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■ PC UPDATE ■ PEGGY GAVAN

Compaq Computer Corp. has added a new model to its line of personal computers. The **Compaq Deskpro 286, Model 20**, priced at \$3,999, has a 20-megabyte hard disk, 640K bytes of RAM, and a 1.2-megabyte floppy disk drive. Compaq also reduced the price of the Deskpro 286, Model 1, with 256K RAM and a 1.2-megabyte floppy disk drive, from \$3,999 to \$2,999. Compaq Computer Corp., Houston, Tex.; (713) 370-0670.

Univision dropped prices on its **PC Turbocharger** and **Dream Board** memory boards as a result of savings in manufacturing. The **PC Turbocharger**, with 128K bytes of RAM, was cut from \$595 to \$395, and the **Turbocharger**, with 640K RAM and the 8087-1 math coprocessor, is now \$995, a reduction of \$100. The loaded **Dream Board** was reduced \$145, to \$1,450, and the 512K-byte **Dream Board** dropped \$100, to \$695. Steep cuts were also made on **DEC Rainbow mass-storage products**: the 20-megabyte internal hard disk dropped \$905, to \$1,595; the **Slimline Hard Disk** subsystem, with one 30-megabyte hard disk drive and a 10-megabyte removable Winchester cartridge drive, is now \$3,595, down from \$5,895. Univision, Milpitas, Calif.; (408) 263-1200.

The ability to support Versions 3.1 and 3.2 of DOS on a single network server is the key feature of IBM Corp.'s **PC Local Area Network (LAN) Program, Version 1.12**. The new version also allows users to cancel print commands sent to the printer, preventing jobs that contain errors from getting stuck in the network print queue. Upgrades are free to registered users upon request from IBM's authorized dealers or branch offices.

Advanced Graphics Software upgraded **SlideWrite** to **SlideWrite Plus**. The new program is not copy protected, creates a variety of text charts and graphs, and can read and enhance graphs from 1-2-3 worksheet files. Upgrades are \$120 for registered owners. Advanced Graphics Software, Sunnyvale, Calif.; (408) 749-8620.

Lotus Development Corp. has developed a 3½-inch-disk version of **1-2-3** to run on the IBM PC Convertible and external 3½-inch disk drives. Registered users of 1-2-3, Releases 2.0 and 2.01, can purchase 3½-inch-disk kits from Lotus for \$50 until December 31, 1986. After that time, the new disks will cost \$495.

New England Software removed copy protection from Version 1.2 of **Graph-in-the-Box**. The new version also supports 7-bit graphics printers and 24-pin printers. The company announced that upgrades are free to registered users. In addition, **Graph-in-the-Box** will be bundled with AST Research's monochrome or enhanced graphics adapter until December 31, 1986. New England Software, Greenwich, Conn.; (203) 625-0062.

Sigma Designs recently added high-resolution drivers to its Color 400 graphics card to support **Microsoft Windows** and Digital Research's **GEM**. The new drivers will be offered as complimentary programs with the \$695 Color 400. Registered owners can receive the drivers for a \$25 shipping and handling fee. Sigma Designs, San Jose, Calif.; (408) 435-1480.

Wyse Technology and Phoenix Technologies released a software driver to support the latest versions of **1-2-3** and **Symphony** on the Wyse **WY-700 high-resolution monitor** and graphics board subsystem. The driver software costs \$25 and can be ordered by calling Phoenix at (800) 843-3787.

Inset 2 offers several new features, including a preview option, which allows users to view merged text and graphics on the same screen, and a built-in graphics editor, which permits the user to alter and size graphics images to fit with the text. Upgrades are \$30 for



Inset 2's new preview option combines text and graphics on the same screen. Here, a 3-dimensional graph is merged with a XyWrite file.

registered users who bought the first version as a separate package and \$50 for those who purchased it bundled or as an option with **MultMate** or **WordStar 2000**. American Programmers Guild, Danbury, Conn.; (203) 794-0396.

In brief: **PC Paintbrush** has been upgraded to **PC Paintbrush +**. The new program supports scanner and laser printers, including those manufactured by Dest Corp., Canon, Panasonic, AT&T, and Taltree. Upgrades are \$30 for registered owners. Z-Soft Corp., Marietta, Ga.; (404) 980-1950. Alloy Computer Products has increased the speed of **PC-9Track**, a tape-drive system that allows PCs to share data with mainframes and minicomputers. The software upgrade is free to all registered users. Alloy Computer Products, Framingham, Mass.; (617) 875-6100. The Western Union **InfoMaster** database is now available 24 hours a day, 7 days a week. InfoMaster may be ordered from Western Union sales offices or by calling (800) 527-5184. **askSam**, Version 3, has many new features, including a document mode that provides unlimited document sizes, a report generator, and a phone dialer. Upgrades cost \$50. Seaside Software, Perry, Fla.; (800) 327-5726. **Lattice C Compiler**, Version 3.1, has an expanded, two-volume **Programmer's Reference Manual**, complete with a bibliography of texts for novice C language programmers. Registered users should follow the procedures on the Lattice Update Card to obtain the new version or call Lattice at (312) 858-7950. The entire line of **SBT** accounting products is now available on 3½-inch disks for DOS 3.2-compatible portable computers. Upgrades cost \$25, plus shipping and handling. SBT Corp., Sausalito, Calif.; (415) 331-9900. **Easycolor** for 1-2-3 now supports 1-2-3, Release 2, in conjunction with an enhanced graphics adapter. Upgrades cost \$29.95 for registered users. The Binary Workshop, Champaign, Ill.; (217) 359-3400.

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TO: Product Support Managers

FROM: Steve Crumney, VP Sales & Service

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WORTH IT

Now
Available!

FIVE NEW MODELS

SHARE PRINTERS AND BUFFER PRINT JOBS WITH ONE VERSATILE UNIT

Print Master from BayTech is an intelligent printer controller that connects between your computers and printers. It allows you to share one printer automatically, contend for multiple printers automatically, or switch between several printers by sending a simple code, not by changing cables. Plus, Print Master's generous built-in buffer spools data until your printers can receive it.

Because Print Master is a very flexible device, you can set it up to fit your application, even if your application changes.

YOU SET UP THE IN-OUT PORTS

You configure Print Master's ports for any combination of printers and computers by answering questions from easy-to-follow menus. For example, with the ten port Print Master, nine computers can share one printer, eight computers can share two printers, seven computers can share three printers, and so on, to one computer which can share nine printers. You can also menu-select the disconnect time-out, form feeds, etc. and on serial models, the configuration of individual ports to translate for printers and computers using different configurations.



512K OR ONE MEGABYTE BUFFER KEEPS YOU WORKING INSTEAD OF WAITING

Since Print Master can accept data faster than your printer (up to 19.2KB serial or 5,000 characters per second parallel), you can send a print job to Print Master's standard 512K buffer and then go on to another project. All users connected to Print Master can send data to this common pool buffer, and they can be doing it simultaneously, even if no printer is available. Data is stored in the buffer until it can

be sent on a first-job-in first-job-out basis to the selected printer. If you need more memory than 512K, Print Master is optionally available with one megabyte buffer.

If several users are sharing one printer, printer sharing via Print Master is completely automatic. There are no codes to send. You simply perform your normal print operation. If you are sharing several identical printers, connection is also

automatic. Again, you perform your normal print operation and are connected to the next available printer on a first-come-first-serve basis. Print Master will send data to all printers simultaneously to keep your printers running at full capacity.

If you are sharing several different printers, such as a laser-jet, a dot matrix and a plotter, and you wish to select a specific printer, you do your normal print routine and also send a printer select code (which you can define yourself) before the first characters of your data. The data is then routed to the selected printer. It's that easy.

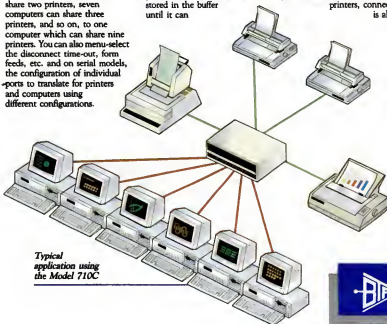
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All above models have standard 512K buffers.
Additional 500K buffer, \$249
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Typical
application using
the Model 710C



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\$99 Smalltalk/V: Bargain Applications Developer

PC HANDSON

BY WILLIAM G. WONG

Digital's *Smalltalk/V* sounds like yet another communications program, but it's really a low-cost implementation of the Smalltalk programming language that was developed by Xerox Corp.'s Palo Alto Research Center and is often credited with popularizing the use of windows and pop-up screens on PCs.

Smalltalk has never achieved the popularity that many feel it deserves. As a powerful object-oriented message-passing system with an inheritance-based class system, its approach has great potential for developers of sophisticated applications.

Smalltalk/V provides a variety of predefined classes, including variable precision integers, floating-point numbers,

fractions, strings, arrays, collections, windows, menus, and much more. It also has complex classes such as "browsers," which combine an editor and index system. The window class supports bit-mapped CGA and

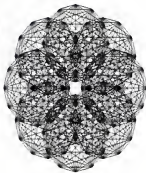
EGA graphics, and drawing speed is very fast.

Almost the entire system is available in source-code form via the class browser. The exception is the compiler, whose source code is not provided.

Flexible Environment

One of the best features of *Smalltalk/V* is its working environment. You can open, move,

EDIT
Walking Time
Dragon
Bordala
MATH portables
Bordala
MATH portables
MATH portables
Bordala
Bordala



Smalltalk/V's bit-mapped graphics support allows editing by bit and form.

PC FACT FILE

Smalltalk/V, Version 1.0

Digital Inc.
5200 W. Century Blvd.
Los Angeles, CA 90045
(213) 645-1082

List Price: \$99

Requires: 512K RAM, two disk drives, graphics controller (CGA, EGA, Hercules, or AT&T), DOS 2.0 or later.
In Short: Powerful window-oriented graphics language and development tool. Not copy protected.

CIRCLE 428 ON READER SERVICE CARD

and size windows at any time, using either a mouse or the cursor pad. Windows can also be collapsed down to their title line so that the screen does not become cluttered. This provides a more flexible environment than a multiple-window editor.

Smalltalk/V also provides
(continued on next page)

Mechanical vs. Optical Mice

PC HANDSON

BY CRAIG L. STARK

Has the state of the art in PC mice advanced noticeably of late? I thought that all mice looked and worked alike, but when three of the little rodents suddenly skittered down the pipe into my office, I had to wonder.

The three—Summagraphics' SummaMouse 455, Logitech's Logimouse C7, and Mouse Systems' PC Mouse—embody two behavioral patterns. The PC Mouse and the SummaMouse 455 are optical mice, which track cursor motion by bouncing light from an LED off a reflective pad and back up to a photoelectric sensor. The Logimouse C7 is an old-fashioned track-ball mouse, much like Microsoft's.

If real estate is a valuable commodity on your desktop, you might prefer a mechanical mouse, since optical mice re-

quire their reflective pads, while you can plunk a mechanical mouse down on a top of a pile of papers and start rolling away. Also, optical mice are electronic instruments and need a power supply, while the Bus Plus version of the PC Mouse draws its current directly from the PC. The SummaMouse requires an AC adapter, which

can be annoyingly restrictive.

Bus or Serial Mouse

Another difference is the way the mice interface with the PC: they can attach to a serial port or to an interface card that plugs into an open expansion slot—hence the term "bus mouse."

(continued on next page)



The PC Mouse, left, uses an expansion slot, while the Logimouse C7, center, and the SummaMouse, right, run off an existing serial port.

PC FACT FILE

PC Mouse (with Bus Plus model, Version 5.0 software)

Mouse Systems Corp.
2600 San Tomas Expwy.
Santa Clara, CA 95051
(408) 988-0211

List Price: \$199

Requires: An expansion slot.

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Logimouse C7 (Version 3.0 software)

Logitech Inc.
805 Veterans Blvd.
Redwood City, CA 94063
(415) 365-9852

List Price: With base package, \$99; with Plus package, \$119.

Requires: A serial port.

CIRCLE 422 ON READER SERVICE CARD

SummaMouse 455

Summagraphics Corp.
777 State St. Extension
Fairfield, CT 06430
(203) 384-1344

List Price: \$119

Requires: A serial port.

CIRCLE 423 ON READER SERVICE CARD

Breakthru 286: Fast, Cheap Turbo Contender

PC HANDS ON

BY STEPHEN MANES

Portable Computer Support Group's Breakthru 286 turbo card delivers high performance at a low price. The half-length board sports an 8-MHz 80286, an on-board clock to drive it at its rated speed (or faster—speed demons will savor the socketed crystal), and a generous 16K-byte no-wait-state RAM cache. An 80287 math coprocessor socket is also included.

Installation involves removing the PC's 8088 chip (and optional 8087) with the prying tool provided. Insert a cable in the 8088 socket and a plug in the 8087 socket, check one system board switch, set four on-board jumpers, stick the card in a slot (the long cable lets you choose which one, ensures compatibility with many clones, and aids fumble-fingered users), and you're ready to boot up.

The Breakthru 286 worked (as few things in our experience do) the first time we tried it—in an ancient PC with a 64K-byte motherboard, a non-IBM hard disk controller, and 2 mega-

bytes of RAM, including expanded and simulated extended memory. The Breakthru 286 performed flawlessly with every application we handed it, including copy-protected programs and nine memory-resident utilities at once.

Slowing It Down

Real-time games presented the sole problem. They ran just fine—but often so fast they required the hand-eye coordination of a Superman. Since the Breakthru 286 has no socket for an 8088 processor and no slow-down switch, the only apparent solution is to disable the cache via the on-board jumpers—which may slow a PC to below its normal speed.

On PC Magazine Labs benchmark tests, the Breakthru posted speeds from 35 percent slower than a plain-vanilla PC in the NOP benchmark test (a common occurrence with caching cards) to a blazing 342 percent faster in the floating-point calculation benchmark test—on a par with an 8-MHz PC AT, as were many other pure computation tests. In a real-world chore involving compiling and linking

a large file, the Breakthru 286-enhanced PC worked 2½ times faster than the original—a speedup limited in part by hard disk access times.

The Breakthru 286's on-board jumpers allow access to additional speed improvements. For openers, device memory may be cached for potentially faster input and output. However, this feature must be disabled if expanded memory is present.

ROM BIOS Caching

A second jumper allows caching of the ROM BIOS, greatly speeding up interpreted BASIC programs and modestly improving screen rewrites. Unfortunately (and not mentioned in the manual), this can interfere with floppy disk operations, causing "not ready" and similar errors. In practice, the problem is minor because the short program that enables and disables the feature can be run from DOS or called from batch files when needed.

The Breakthru 286 comes with Portable Computer Support Group's excellent *Lightning* disk-caching program for

Installing a Breakthru 286 is easy, thanks to the chip-prying tool included: you remove the PC's 8088 and plug in the turbo board cable.

an additional dollop of speed. Backed by a 60-day money-back guarantee and a 1-year warranty, it's a powerful combination at a very attractive price.

PC FACT FILE

Breakthru 286

Portable Computer Support Group
11035 Harry Hines Blvd.
Dallas, TX 75229
(214) 351-0564

List Price: \$395, including *Lightning* software.

In Short: The Breakthru 286's high compatibility, low hassle, and reasonable price make it easy to turn a potential PC retiree into a virtual XT, Model 286. Includes the excellent *Lightning* disk-caching program.

CIRCLE 446 ON READER SERVICE CARD

Smalltalk/V

(continued from preceding page)

transparent virtual-memory support, which allows you to create very large programs. A RAMdisk provides the best swapping support because of its speed; hard disks are an acceptable alternative.

The documentation is a single book that combines an introduction to *Smalltalk/V* with a tutorial and a reference manual. The package is suitable for learning *Smalltalk* without additional reference material.

At \$99, *Smalltalk/V* is an excellent buy and makes a good alternative to other programming languages for the development of complex applications.

MICE

(continued from preceding page)

Since there are no intrinsic advantages to either variety, the decision between bus and serial mouse can be made on the basis of one factor alone: whether you are more lacking in serial ports or expansion slots. The PC Mouse has the best solution of all, adding a 9-pin RS-4T-K serial port (like the AT's) to its bus interface card.

All three mice worked fine when tested with operating environments such as *Microsoft Windows*, which is designed to take advantage of a mouse. All also came with prewritten drivers for other programs, the most popular being Lotus's *1-2-3*,

which isn't designed for a mouse. The *1-2-3* drivers for the Logimouse and PC Mouse worked well, and after some getting used to could increase your productivity. But strangely, the Summagraphics *1-2-3*

Mouse, which besides *1-2-3* and *Windows* also talks to *Multiplan*, *VisiCalc*, *SuperCalc*, *MultiMate*, *WordStar*, *WordPerfect*, *Javelin*, *dBASE III*, *Microsoft Word*, *Symphony*, *Framework*, and more. All

The PC Mouse and the SummaMouse 455 are optical mice. The Logimouse C7 is an old-fashioned track-ball mouse.

driver was limited to file-manipulation functions and provided no help in actually moving around the spreadsheet.

The prize for the longest list of drivers goes to the PC

three mice also come with programs that let you define your own interfaces, but in all cases these are complicated and are not intended for the nonprogrammer.

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Cancel That Carload of IBMs, Miss Winters, and Get TAB on Line 2

More words of wisdom from the ill-fated *MS-DOS Technical Reference Encyclopedia*. From the authors' recollection of the speculation that surrounded the introduction of the IBM PC comes this excerpt from the July 21, 1981, issue of the computer industry trade paper *Infoworld*:

"IBM is in for some rough competition. Xerox, which announced its model 800 personal computer last month, is expected to give IBM the biggest headache in the small-computer competition, but TAB Office Products, Burroughs, and Lanier Business Systems are all working on similar products to announce later this summer. None of these firms share IBM's hesitancy to use Digital Research's CP/M as an operating system, so IBM may find itself with a competitive system, but little or no software to compel potential buyers."

Company With Allure

Brooktrout Technology of Wellesley Hills, Mass., maker of PC-based voice-messaging systems and add-in boards, is not afraid to go with the flow. According to Brooktrout president Eric Giler, the company name was the idea of one of the company's founders, Pat Hines, who "gets his best ideas while fishing."



Just the thing for the back window of your Volvo wagon, right above the "This Car Climbed Pike's Peak" and "No Nukes" bumper stickers. The disks are \$1.50 each and although only single-sided, they can be formatted and used.

Woz

.....

LIMITED EDITION

Impress all your friends: buy a new Apple II GS before December 31 and get Steve Wozniak's signature on the case. Stuff the receipt in your Calvin Klein jeans. Drive the machine home in your Bill Blass Lincoln Continental.

Printers

(continued from page 36)

11, the NEC Model 3550 Spinwriter, and the Epson JX-80 printer.

Four internal fonts are standard with the AMT Office Printer, and another 18 are available from the manufacturer. Extra fonts are \$85 apiece.

In addition to the configured

emulation, the AMT Office Printer will also follow special AMT printer control codes, including graphics codes.

Print quality (including a precise letter quality, rougher draft, and midpoint memo quality) is selectable from the front-mounted control panel, as are many of the standard parameters, such as page length, characters, and lines per inch. Fonts

are also easily selectable even in the middle of a printing job.

Bidirectional Tractor

I found the optional (\$150) bidirectional forms tractor-feed mechanism a pleasure to load and use. The printer controls most of the paper loading, including moving the paper bail out and back in when appropriate.

Caution: Nitwit on Board

Vanity plates, fuzzy dice, "I Brake for Blondes" license plate holders, and *Playboy* air fresheners—expressing yourself while driving is an American tradition.

Now comes "Floppy on Board," a series of yellow floppy disks patterned after the ubiquitous "Baby on Board" warning signs. Among the sentiments available:

"High-Tech Baby on Board"

"I'm User Friendly"

"Programmed to Shop"

"Check Out My Hardware"

"ROM (Read Only Men)"

Each disk, with a suction cup in one corner, is \$3.50. The maker, Passeez-Sonoma Co. (2458 W. Lomita Blvd., #124, Lomita, CA 90717; (213) 539-9577), says the single-sided disks can be formatted and used, if desired.

Be careful where you use the disks. Some states, in an anti-Yuppie backlash, are ticketing motorists who display the trendy signs for obstructed windshields.

Heard or seen anything offbeat about computers lately—jokes, typos, odd stories, computer-related license plates, outrageous claims?

Send them to *CommuniQs*, PC Magazine, One Park Avenue, New York, NY 10016; (212) 503-5293 or MCI Mail 157-9301.

We'll send you a PC Magazine T-shirt and \$50 for each item used.

Contributors to this issue: Paul Somerson (Microsoft encyclopedia) and Peggy Gavon (Floppy on Board).

As its name suggests, the AMT Office Printer is intended to be an office workhorse. Its rugged design and flexibility make it a good candidate for the one-printer office or for a user who wants to move up from a first dot matrix printer but doesn't have the desk space for both a high-speed matrix and a letter quality printer.

No other video adapter revs up as much software, drives as many monitors, or fine tunes as many graphics.

STB Systems has just combined the technology of the industry's five most popular video display adapters: the IBM Color Graphics and Monochrome/Printer Adapters, the Hercules Graphics Card™, the Tseng UltraPAK-S™, and the STB Chauffeur™.

With the new Chauffeur HT™, the world's best graphics capabilities are at your service.

Roll through any software.

The Chauffeur HT lets you use any and all standard CGA or MGA compatible software. No preboot software or special drivers are needed.

Drive a fleet of monitors.

With The Chauffeur HT, you can emulate any color graphics software, producing 16 shades of gray on any IBM compatible monochrome monitor. CGA 200 line graphics modes are expanded to a full-screen format. Text is displayed as high resolution 8 X 14 characters.

The Chauffeur HT displays Hercules compatible software at 720 X 348; it provides a 1024 X 348 display mode for the CAD/CAM market, and a crisp 132 column display for spreadsheet and terminal emulation users.

Using any standard RGB color monitor or Enhanced Graphics display, you can produce monochrome quality text while maintaining high resolution, 16 color graphics. Even Hercules compatible software can be produced on enhanced monitors.

Enjoy the extras.

In addition to giving you greater graphics capabilities on a wider range of monitor types, with a wider selection of software,

The Chauffeur HT gives you a standard parallel printer port, an optional clock/calendar, a light pen interface support, PC Accelerator software, and full compatibility with the IBM PC, XT and AT.

	IBM PC/XT/AT	IBM PC/XT/AT	IBM PC/XT/AT	IBM PC/XT/AT
Standard Graphics Display	Yes			
RGB Color Display	Yes		Yes	
Monochrome Display	Yes	Yes	Yes	Yes
35 Kilo Display	Yes			
Local Network				
IBM Monochrome Display	Yes	Yes		Yes
IBM CGA	Yes	Yes	Yes	
Hercules Monochrome Graphics	Yes			Yes
128 Kilo Display	Yes			Yes
Printer Support				
Parallel Printer Port	Yes	Yes	Yes	Yes
Runs all CGA, MGA Hercules Compatible software (no driver required)	Yes			
Clock/Calendar	Optional	Optional		Yes

Honk for more information.

For detailed information on The Chauffeur HT, call or write STB Systems, Inc., 601 North Glenville, Richardson, Texas, 75081. (214) 234-8750.

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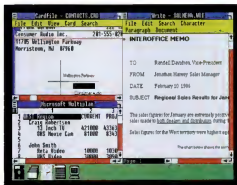
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Windows is a graphic extension of MS-DOS® which adds a powerful new dimension to the system. A more inviting interface of pull down menus, dialog boxes, scroll bars, and icons. Which give you a more intuitive way to work.

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To break the 640K DOS barrier MicroWay designed a Memory Management Unit (MMU) that is tailored to DOS plus a 2000 byte resident driver—MegaDOS™. MicroWay calls this breakthrough Extended Conventional Memory. When you type CHKDSK with the board installed, your system will report 1,036,288 bytes total memory and 1,010,016 bytes free! Any conventional DOS program can utilize a full megabyte for data or code without changing a byte.

Downloading a mainframe application? ECM memory runs with any program that uses DOS for screen services including RM and MS FORTRAN and MS and LATTICE C! This means you have an additional 384K available for oversized applications. Programs which write directly to the screen require a simple patch to adhere to the new standard. MicroWay has already developed patches for the Lotus, WORDSTAR and AUTOCAD screen drivers. Release 1A of 1-2-3 jumps from 535,516 to 916,444 bytes available and runs faster than Release 2 for most worksheets.

Number Smasher/ECM is 100% compatible with all hardware and software including EMS and EGA boards. The compatibility is a result of control: its speed is switch, keyboard or software selectable from 4.77 MHz to 12.0 MHz. Applications which have not been upgraded to ECM can still be run by setting DOS to 640K or 704K and using the memory above DOS for I/O enhancers.

Number Smasher/ECM runs floating point bound programs faster than an AT or any other 80286 based machine. In fact, Number Smasher's 12 MHz 8087 runs a factor of three faster than the standard 80287 on the AT, delivering up to 125 kflops. Software is included for RAM Disk, print spooler, and disk caching, which speeds up floppy and hard disks by a factor of 2 to 10!

Number Smasher/ECM is the most cost effective productivity tool you can buy. The base board which runs at 9.54 MHz comes with 512K and costs only \$599! The complete system which includes a motherboard accelerator, one megabyte of memory and a 12 MHz 8087 is just \$1199. Call today to discuss your particular configuration. Remember: "The advantage of buying from MicroWay is outstanding personal service." (PC Magazine, 6/10/86 - p. 162)

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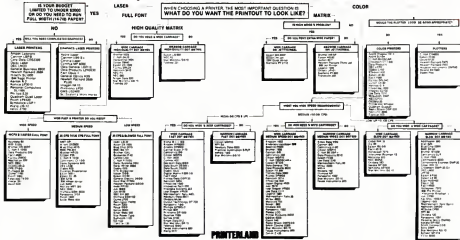
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— PC Week

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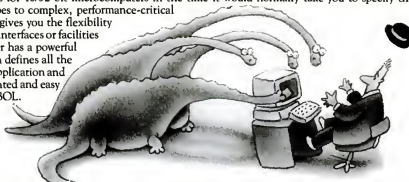
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PC MAGAZINE ■ NOVEMBER 11, 1986

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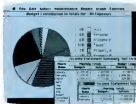
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■ FROM THE EDITOR'S SCREEN ■ BILL MACHRONE

FORM FOLLOWS FUNCTION

The general acceptance of compatibles has ruined the brand-name recognition of PCs. We'll be lucky if we can recognize the next generation at all.



The Clone Wars are over. Users have transcended their need for their compatibles to be slavish copies of IBM. IBM is working hard on custom gate arrays to do higher integration of virtually every part of the PC, in a frantic effort to bring down manufacturing costs and make cloning more difficult.

It's too late. As I've said before, DOS is the standard, not IBM. Bill Gates has won. He's created a software bus that is capable of linking dissimilar machines. Today, the machines are not especially dissimilar. But over the next year or two, you'll see significant divergence in hardware, with DOS anchoring these new machines firmly to the mainstream.

Time was that anything that varied too far from the IBM look, even down to the color, didn't have a chance in the marketplace. Now designers are taking liberties with the form factor: they're coaxing the boring beige box into new and interesting shapes, shapes that will take the PC into new places and applications.

SMALLER WILL BE BETTER The best thing about the new gate arrays and custom VLSI chips is not lowered manufacturers' prices (although we never object to a better buy) but smaller form factors. Small size will be a major advantage as the PC takes on new markets. One such opportunity is telemarketing. Tens of thousands of people in this country have telephones and some kind of computer hookup on their desks. Some sell. Some take orders. Others give information. In each case, the hookup is expensive. It's next to impossi-

ble to put a phone on a worker's desk for less than \$600. It's getting possible to put a PC on that desk for the same amount of money, but not one with the same old shape and size.

A telemarketer's PC needs to be different. It needs to take up a minimum of desk space (marketing systems are still notoriously paper driven). It needs an oversized screen. It needs to be integrated with the telephone, managing multiple lines with voice synthesis, conferencing, and intelligent call diversion. We'll need that oversized screen for the future, when order entry and customer information systems will become more computerized and the user will need to see a significant amount of information from both systems on the screen at the same time, while maintaining an active window for word processing and other personal productivity applications. If the screen is a flat panel, so much the better. The LCD screen in Zenith's new Z-181

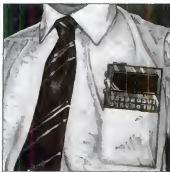
laptop is of the caliber, if not the size, required for office use. Its jet black characters look as though they were painted on the silver-blue surface.

Why a PC for such specialized applications? Because that's what businesses buy when they think of individual productivity. It's also where all the applications programming action is. It's also the backbone of intermachine connectivity, and connectivity is the lifeblood of future PC growth. In fact, if IBM is to survive the changes in the market, it needs to pioneer some of these specialized, noncommodity machines.

COMPUTER AS ART To show just how far you can go with miniaturization and functionality, Jay Bell, one of the designers at PC's Limited, has proposed an AT that you could frame and hang on a wall. His idea is that you would take all the silicon chips that would normally go on the motherboard and put them onto a single substrate, before they were inserted into their usual black plastic caterpillar packages. Bell would then interconnect the chips with bonding wires, just as the manufacturer would to connect the chip to the package. Thick film construction techniques would take care of the few elements that weren't on the chips.

Heat buildup would normally destroy such a compressed layout in a matter of minutes. Bell's innovation would be to back the substrate with a thermionic element.

Remember the thermionic device? It's a form of semiconductor with unusual



■ FROM THE EDITOR'S SCREEN

properties. You connect a voltage one way and it gets cold on one side and hot on the other. Connect it the other way and hot and cold reverse places. Thermionics was supposed to revolutionize refrigeration, but it

fizzled. The devices, however, still work and are in everyday use in aircraft and satellites. Why not in the office? Volume production might just make thermionics affordable.

Such a PC wouldn't need to be any bigger than its disk drives and connectors. It could camp under the keyboard or behind your photo of the kids. Is it practical today? No. Is it possible? Yes. And that's what really matters. Sooner or later, someone is going to have an application for a machine that's PC compatible and no larger than a Stephen King novel.

Remember that there is a standard for a 1.4-megabyte, 3½-inch disk. DOS 3.2 already supports it; the drives will be ready this fall and will appear in new machines next spring. Also, Sony and Maxell have defined 2½-inch disks with similar data capacities. All that remains is to build them.

Today's PCs are the functional equivalents of the old Philco radios. They're furniture. They're planned for, stepped around, piled upon, and treated like visiting royalty.

Tomorrow's PC will be more like equivalents of the Walkman: part of our lives, with a pick-up-and-go quality. Most personal stereos permit you to play your own music through tapes or to tune into the world via radio. Tomorrow's PCs won't be much different. They'll be self-sufficient, with ROM- and disk-based programs, and you'll be able to hook up and network them at the office, simply by plugging them in. Imagine a fully functional PC that picks up your electronic mail all day, alerting you to the important stuff, filing the rest away by topic or sender. You drop it in your briefcase and review and respond to the rest on the commute or with your feet up at home.

FLYING PCs This future is closer than we think. Tandy has already field-tested a cellular phone with an RJ-11 jack built into it, so you can use your machine via modem from remote places. The next generation of commercial jets is being designed with telephone hookups at every seat, to improve the quality of air-to-ground communications and to let passengers' personal computers hook into ground-based databases and electronic mail systems. As exciting as this is, I'm not looking forward to the day when I can be telephoned while on board an airplane.

But, by then, my PC will be able to screen my calls.

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■ JOHN C. DVORAK

IT'S NOT THE DISPLAY, IT'S THE GESTALT



If there is a real market for the laptop computer, Dvorak can't find it. It's not only that their screens are unreadable or that they weigh too much. The little suckers just don't feel right.

My take on the laptop computer is that it's a big dud. There's no real acceptance. Okay, some auditors buy them so they can add numbers in the airport lounge. Some newspapers buy them, and some writers even carry them along to press conferences to annoy *real* journalists by clicking away while the *real* journalists scribe in their reporter's notebooks. The real journalists don't get too upset about occasionally having to lug one around on the road. But this hardly constitutes an avalanche of demand. What's the problem?

I've tried lugging various portable computers here and there every so often and have hated them all. I always thought I hated them because they were either too heavy or because their LCD displays were unreadable.

Ignoring the weight factor and assuming the display is readable doesn't help, as it turns out. That's not really the problem, just a set of symptoms.

Let's forget the 20-pound clunkers or the 14-pound bowling balls; let's just consider the less-than-5-pound true lappers (of which I can think of exactly two). I can't get over the notion that they aren't much more than toys. T-O-Y-S. Take them seriously? Forget it. Write with them? Not at all easy. I don't mean writing *War and Peace* either, I'm talking about typing "Hi, how are you" on one of these things. They simply don't "feel" right.

Simply put, it's not the display—it's the gestalt. Forget the LCD.

Everything about the little suckers is annoying. When I type on one it moves all

over the table like some shy puppy avoiding a pat on the back. Greased pigs is a better analogy. These aren't writers' tools for man or woman. Kids, maybe.

THE CULPRIT It's Alan Kay's fault. Some years back in the early 1970s, as I recall, there was a *Playboy Magazine* article about Kay that described his now-legendary Dynabook—a little book-sized computer. Someday in the fuzzy future everyone was supposed to carry one of these machines around, and all the world's knowledge would miraculously pop from it. Today, the Dynabook looks a lot like a Tandy 102, but they somehow left out all the world's knowledge.

Kay is an idea man. I, like many other cynics, cannot figure out whether he's the genius of the century or a charlatan. After all, he has never produced a product as far as I know. I like to equate him with great programmers. The greater the program-

mer, the less likely he is to ever finish a project. He can never get it "just right." It always takes a manager to jerk it out of the programmer's hands and give it to some practical guy or gal to send the product to market.

As a great programmer never finishes a program, I suppose a great idea man never finishes an idea. Kay never finished an idea at Xerox's famed Palo Alto Research Center (PARC), never finished an idea at Atari, and now at Apple he is busy grinding out still more unfinished ideas. This inability (or ability—depending on your point of view) has left more than a few good ideas hanging in idea limbo. The portable computer (Dynabook) is one.

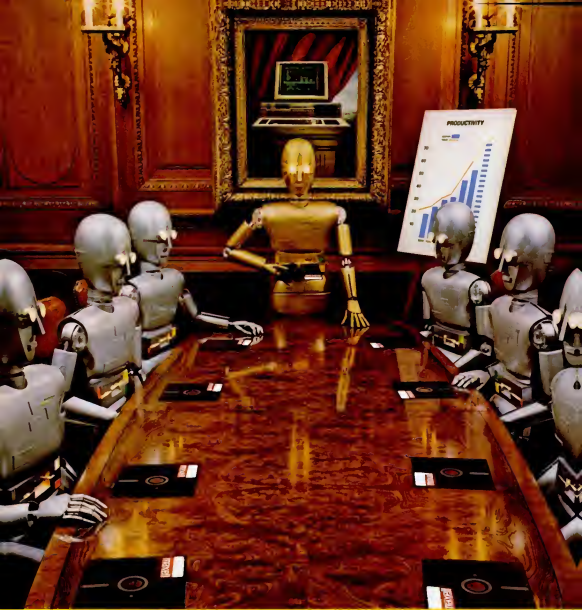
So it's up to guys like me to finish (or finish off) the idea.

PERFECT PORTABLE So let's finish this one off. My portable computer is a case that holds ten disks. I mooch a computer wherever I go and that takes care of the portability problem. All I need to carry is some personal software. Moreover, my case of ten disks weighs about the same as a double-cheeseburger—the perfect weight for a portable.

In the future the hotels of the world will make computers available for the asking. You'll find them in airport lounges, bus depots, libraries, all over. It will cost \$10 or so a day to rent one, and they'll all be IBM compatible. When that happens, who'll need a laptop?

Now when they put all the world's knowledge in one of the little buggers, I may change my attitude.





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THE GOLD STANDARD

■ JOHN C. DVORAK

INSIDE TRACK

The writing is on the wall: software prices are about to take a big plunge.

Borland (Boár-land) *vt* [OF, fr. Kahn, Con <from Philippe, meaning phil up, or fill up the wallet> Pidgin Eng. Boreland, mong. Meaning bore into land; to bore into the land in hopes of finding oil] (1) To attack a competitor using a technique of under-selling (see Garment Industry) (2) To bring to total defeat; crush (3) To do away with (4) To sell software for less than \$100 (5) To panic an industry (see Microsoft) — *vi* To bring about a change in pricing philosophy (see Borland effect) — *n* (1) A software company in Scotts Valley, California (2) A fictional character, Frank Borland

In this business we've always known that **low prices for software** would someday come. Let's face it, a perfect-bound paperback book and a floppy disk shouldn't cost that much more than a perfect-bound paperback book without a disk. About a **dollar** more is my guess.

Nobody knows when a **whole hog change** in pricing strategy will happen. This may be the year.

While **Borland International** pioneers successful low-priced software and makes a real business of it, it was **Microsoft's** entry with its \$99 QuickBASIC 2.0 that signaled the **beginning of the end** for high-priced popular software. Now, within the last month or two, one company after another is bringing out something inexpensive and worth the price.

What got my immediate attention was **SmallTalk/V for the PC at \$99**. This is the real thing, folks. A super **SmallTalk** like this turns your PC into a hot workstation. It's fantastic. It prefers a Hercules or EGA-based display system. **Highly recommended.** From Digitalk, 5200 W. Century Blvd., Los Angeles, CA 90045; (213) 645-1082.

Soon after I received the low-ball **SmallTalk I** got a review copy of the highly regarded **Volkswriter Deluxe Plus** from Lifetree Software. It's now \$99. (Phone (800) 543-3873 or (800) 831-8733 for information.) Such a deal. The beat goes on with Businessoft's unique word processor, **MindReader**. It's been repackaged and will sell for \$65. (Phone (301) 263-1962.) **Leading Edge is selling its word processor and its spreadsheet together for \$99.** (Phone (617) 449-4655.) Expect to see a pell-mell repricing and repositioning of the entire software industry within the next year. This is just the beginning.

The major change in software prices is simply the result of the **failure** of the retail channels (aka storefronts) to sell software. Like a **cheap** record store in a one-horse town, the stores only carry a few "hit tunes" and sell them at full retail. Then the store owners **complain and moan** about the discounters and mail-order guys. Meanwhile, most stores have nothing to offer and employ dokey salesmen or **B.S. artists** while making the stores uncomfortable for the browser. Needless to say, I'm not sympathetic to their plight.

Anyway, because the retailers have failed to grease the wheels of industry and provide an outlet for some wonderful stuff, the **hapless** software vendors have had to resort to direct sales. Direct sales means low prices, new packaging, and a new attitude. Perhaps one day we'll see the **demise of the IBM binder-in-the-box** package because of these changes. Two years ago it was dumb to put your software in anything but the IBM binder in a box. Now it seems like a waste of money. The new package is the disk in a shrink-wrapped book.

This Is the Book to Read Dept. If you want to be part of the "in" crowd this year, then the book to read is *The Connection Machine*, by W. Daniel Hillis (MIT Press). Written as a doctoral dissertation, this book is about a new **non-Von Neumann computer architecture** and the need for such architecture in the future. Specifically, it's about a new parallel multiprocessor design created for use in artificial intelligence systems. Everybody who is anybody has read this book. It's only 179 pages, and if you don't want to get into technical details, you only have to attack the 30-page introduction to be able to hold your own at a cocktail party. Hot stuff.

While on the Subject of Hot Stuff Dept. The Toshiba T3100 light portable (a new category) PC AT clone is selling like hotcakes. This machine has a 10-megabyte hard disk, an 80286 chip, and a plasma display. **It's not a laptop.** It needs a plug and it weighs too much. I like it except for its laughable carrying handle. It's positioned so the computer isn't balanced and just won't hang straight down when carried. It swings out at an angle. If you hold it one way, the bottom of the computer bashes into your leg. If you hold it the other way, it swings out and makes you look like a **bonafide dork** as you walk. I hope they'll change this feature. Other than that, it's hot. So hot that rumor has it the company can't meet demand, and I hear that Toshiba has the external 5¼-inch subsystem (the T3100 uses 3½-inch disks) on the back burner hoping a third party will move in. Any takers? There's gold in them thar hills.

Borland Anecdote Dept. From Mike Drips, ex-retailer and gadfly, I get this memo: "I'm using Turbo Lightning to do my spell checking. I can't believe that they actually left the word 'turbo' out of their dictionary. They also left out the word 'Borland'!"

Hey, we all overlook the obvious. ☞

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—Joe Desposito, PC Magazine, July, 1986

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—Winn L. Rosch, PC Week, June 3, 1986

"The 286¹² is a well-designed machine that offers outstanding performance at a reasonable price."

—Joe Desposito, PC Magazine, July, 1986

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■ PETER NORTON

NOTES FROM THE MAILBAG



Norton's readers are a fascinating bunch. Here he responds to some of their tips, complaints, and suggestions about laptop computers and the intricacies of formatting disks.

Readers suggest some fascinating topics for this column, but a recent idea from Peter Buswell of Waccabuc, New York, takes the cake. He wrote in asking whether he was "the only nut that has ever left his battery charger plugged into the shavers-only socket in the restroom of a Boeing commercial aircraft."

Since I'm a Seattle boy and loyal to Seattle-based Boeing, I wouldn't think of leaving my portable computer's battery charger plugged into any other kind of aircraft. It strikes me, though, that if enough of us do it, there'll be a charger left in every restroom in the sky and we can stop having to haul the weighty beasts around with our machines.

Silliness aside (it's only silly if you haven't arrived somewhere with a dead computer and no battery charger), it is worth noting that anyone who uses a laptop PC has to face the surprising reality that all the external parts (chargers, power cords, external 5¼-inch drives, mice, printers, and so on) you have to schlep around with your machine can double its actual size and weight. If you're contemplating buying a laptop, you should look beyond the machine's advertised weight and seriously check out the total pile of equipment you'll have to lug around. You might decide that a Compaq Portable II competes better against a laptop machine than you thought.

FORMAT WARS In a previous discussion of hard-disk formatting and partitioning, I talked about the difference between

physical and logical formatting, which are separate operations on a hard disk (although they are combined on a floppy disk). I mentioned that you can change the physical formatting of the hard disk by using IBM's Advanced Diagnostics package or its equivalent. It lets you change the interleaving factor from the normal factor of 3:1 to a more efficient 2:1 or 1:1 which, under some circumstances, can radically alter the performance of a disk. Daniel Gunter of Auburn, Alabama, wrote in to take me to task, pointing out that low-level physical reformatting can have some disastrous consequences.

BAD SECTORS I'm all with Dan. The reason, as he points out, is simple: when a hard disk is checked out and set up at the factory, the low-level formatting is usually done very conservatively. If a sector of the disk is at all shaky, the factory formatting skips over it, marking it off as unusable. In

redoing the low-level formatting, you run the risk of some of these questionable patches passing inspection and being used to store data. What you gain is minimal compared with the added risk that these areas will go bad, blitzing a file.

The moral of the story is to take your hard disk as it comes and don't try to revise the low-level formatting, unless you enjoy living dangerously, that is. Setting aside that measly 10 or 20 or even 50K bytes of "bad sectors" on a new hard disk protects your precious data.

FLOPPY FORMAT FOLLIES Several readers have written in with an oddball discovery that I've also run into myself. The high-capacity 1.2-megabyte floppy disks that were introduced with the IBM PC AT have created a default standard in one sense: if your machine has a high-capacity drive and you want to format a regular 360K-byte disk on it, you have to specify the switch /4. If you omit the switch under DOS 3.0, the FORMAT utility will try to format the disk as a 1.2-megabyte disk, fail, and then completely reject the disk (instead of, as you might hope, just stepping back to format it as a 360K-byte disk).

With the latest releases of DOS, however, the FORMAT command does something different and wonderfully peculiar. Now, FORMAT succeeds (superficially) in formatting the disk as a 1.2-megabyte disk, but only about 300-odd K bytes of that formatting work: the rest of the disk is marked off as about 840K of "bad tracks."



■ PETER NORTON

Needless to say, you've gained nothing when this happens, and you have created a formatted disk that is dangerously unreliable to use. But you do have a weird curiosity on your hands.

TRY AGAIN What happens is this: when your computer is formatting a disk and it gets to a bad patch, it retries it a few times just to see if the problem is a temporary fluke. The best way for FORMAT to

■ When your computer is formatting a floppy disk and it gets to a bad patch, it retries it a few times just to see if the problem is a temporary fluke.

shake out of an error (and perhaps to literally shake off a spot of dust) is to bang the read-write mechanism back to the beginning and then reach out again to the track where it encountered the flaw. This is a lengthy and noisy process that can make formatting a disk sound like grinding coffee (and take as long as brewing coffee). That's all part of the bizarre "fun" of trying this experiment.

Although I haven't investigated it deeply enough to be sure, I think that what's going on with the newer versions of FORMAT is that defective parts of a disk get rejected in smaller chunks. A regular disk normally has 8 or 9 sectors of data around each circular track, while a high-capacity disk squeezes in 15. By the old rules, if FORMAT couldn't fit in the entire 15 (in high-capacity mode), the entire track would be dumped. Apparently, by the new rules, FORMAT rejects only sectors that don't take, so that the working part of a regular 360K-byte disk is accepted as a severely crippled version of a high-capacity disk.

If you try to format a regular disk as a high-capacity disk, you get no more usable space than the 360K bytes you would ordinarily get; you just get the normal amount in the form of a very defective fraction of the 1.2-megabyte layout of a proper high-capacity disk.

EXTRA DENSITY Since high-capacity disks fit 15 sectors in a circular track and 80 tracks across the disk's surface (instead of 40), the disk drive has to have a special recording head and the magnetic coating on the disk must be a "high-coercivity"

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■ PETER NORTON

coating that can handle the extra recording density.

This high-coercivity coating is actually quite similar to a regular disk's coating in the way it works (the chemistry and manufacturing process is another matter). Crudely put, it's all just a little bit of magnetized rust glued onto plastic. Think about it: the whole multibillion-dollar disk-storage industry—and all of your precious data and programs—relies on just a little bit of magnetized rust.

Since the high-coercivity coating of a high-capacity disk isn't substantially different from a regular disk's coating, it turns out that some regular disks can be formatted as high-capacity floppy disks and get most of the 1.2-megabyte format size in a usable form. A really good-quality, double-sided disk can, it turns out, take on the 15 sectors and 80 tracks of a high-capacity disk.

I've had reports of regular disks being formatted for high-capacity with only a few "bad track" rejects. In one case, the

■ Think about it: the whole multibillion-dollar disk-storage industry—and all of your precious data and programs—relies on just a little bit of magnetized rust.

whole disk formatted cleanly, with no bad tracks at all!

Needless to say, it would be foolish to try to actually use one of these disks that way. Real high-capacity disks may be a little expensive, but for a very important reason: they're made to deliver high-capacity performance *reliably*. Getting a regular disk to hold 1.2 megabytes of data is an interesting curiosity and worth trying if you like to experiment with your PC, but it's definitely not a safe way to store your data.

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■ JIM SEYMOUR

ON TELLING THE TRUTH

Users and vendors have something in common: they both tend to stretch the truth when it comes to PCs. Why are we being less than honest? Whom are we really fooling?



"Look, it's OK to tell the truth. Trust me: it'll turn out all right. We don't have to tell these little lies." I know I sometimes offend audiences when I tell them that, but the number of people who crowd the podium after those talks, telling their own little stories about the grief they've come to over someone's whoppers about PCs and PC products, leads me to continue.

Some vendors in the PC business have gotten so used to fudging it here, nudging it there, that they seem surprised when I call them on their actions. But their offended dignity is nothing compared with PC users' squeals when I point out that we users do the same thing.

VENDOR TALL TALES On the vendor side of the street, shading the truth usually falls into two categories: misused specs and improbable justifications.

I'm not as bothered by blatantly false product specs as I am by the sneaky stuff that gets passed off. Like slow hard disks, for example. One of the great PC scams began a few months after the introduction of the PC AT in August 1984.

Because filling the distribution pipeline for the AT took a lot longer than anyone expected and early users reported hard disk problems and dealers always seek higher margins, a lot of resellers bought barebones ATs and rounded them out into working systems with hard disks from third-party vendors.

Fine. The same thing happened with the XT and will probably happen with every PC we see from IBM for the next sev-

eral years. A lot of third-party stuff is better than IBM-labeled components, anyway, so what's the problem? Weren't these systems often great bargains?

Not necessarily.

Because as is now fairly widely known, a lot of dealers stuck old, slow, PC-XT-speed hard disks—disks with typical average access times of 75 to 90 milliseconds—into those ATs. This threw away a lot of the performance those AT buyers thought they were getting.

If Hal Prewitt and his buccaners at Core hadn't blown the whistle on the dishonest dealers and begun distributing an easy-to-use access-time test program, we'd probably still see people stuffing sludge drives into their ATs.

Or take the infamous "Shannon Text" test for speed measurement on printers. The so-many-characters-per-second figures delivered by a Shannon test have about as much relationship to what you'll

actually get in typical applications as the price of corn has to the price of corn-fed beef.

This is a fine example of how an industry institutionalizes self-deception: everyone in the printer business knows the Shannon test is nonsense, yet everyone uses it because, as they say, "Everyone else uses it—and besides, everyone knows it doesn't mean anything."

Except innocent buyers.

IMPROBABLE RATIONALIZATIONS

Both those examples come from the world of misused specs. Last week I saw a doozy from the wildly improbable rationalizations school.

A vendor with a very good mass-storage product, which I happened to like a lot, proudly handed me a detailed cost-justification document. It went on to conclusively prove that because this unit could retrieve the average file in 2 seconds instead of the usual 4 seconds, it would improve the productivity of the typical senior engineer by 15 percent. So, it continued, if two senior engineers shared one of these units, you could recover its cost in just 7 months.

Anyone who's seen the typical senior engineer at work knows perfectly well that cutting 2 seconds off file-retrieval times isn't going to produce a detectable improvement in that engineer's productivity. Most of a senior engineer's computer work—most of almost any professional's work at a PC—consists of pecking away at the keyboard, thinking, musing, staring off into space, and trying new values. Not reading in files from a hard disk.



■ JIM SEYMOUR

Why do people say things like that? Why do they put them into print?

But PC users do exactly the same thing when, for example, they're asked to determine whether PCs have made a difference

at their firms, with an increase in productivity that would more than offset the purchase and training costs associated with those PCs.

They're afraid that the numbers don't

look good enough, so they tweak 'em. Up. By a lot.

I've been on a lot of teams set up to measure PC-related productivity increases. Every time we've had reasonable controls and been realistic about the improvements, we've come up with numbers in the range of 10 to 15 percent.

RIDICULOUS USER-CLAIMS Yet I see a lot of reports that claim productivity improvements of 40 percent, 50 percent, sometimes 100 percent. What does that mean? Were those people who are now 100 percent more productive even showing up at work before they got PCs on their desks?

Certainly there are special cases where someone became 40 or 50 percent more productive once a task was moved to a PC.

■ There are special cases where someone became 40 or 50 percent more productive once a task was moved to a PC. But those are anomalies, not average figures.

But those are anomalies, not average figures. Yet, dear readers, we bump up figures about as much as vendors do. Because we don't trust the numbers.

"Look, Ed, if we show a 12 percent productivity increase, that means it'll take the company a year to get their bait back on these things. Which means we're going to have trouble getting those 386s we want. Let's push that up just a little to, oh, say 40 percent. That'll be a 4-month payback, and management'll be pushing us to get those 386s in here."

Friends, trust me: the numbers are really OK. PCs are grand and glorious tools, and we don't need to make 'em sound better than they really are. Let's stop the fibbing.

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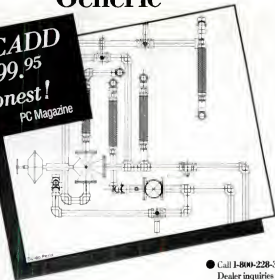
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Captain's Log... War Date 10.01.44



"Captain's Log, October 1, 1944. 0250 Hours. Reel submarine USS Hammerhead proceeding Southwest at cruising speed. Our mission: Intercept enemy convoy off the coast of Borneo. Dispense and destroy."



"0300 Hours. Two hours until dawn. Radar picks up convoy, escorted by two destroyers. We believe that one of the enemy's valuable cargo ships is part of convoy formation."



"0400 Hours. Lookouts on the bridge. Target identification party reports one cargo ship, 4,000 tons, troopship of 10,250 tons, with two Kaibak on-type escorts. Moving into attack position."



"0500 Hours. Sound General Quarters! Battle stations manned. Preparing for torpedo run. Gauge Panel OK. Periscope OK. Charts and Attack Plot Board OK. All mechanical systems OK."



"0525 Hours. Torpedo rooms report full tubes forward and aft. Battery at full charge for silent running. We hope water temperature will provide thermal barrier to confuse enemy sonar."



"0600 Hours. We are at final attack position. Convoy moving at 10 knots. Target distance decreasing rapidly....Crash Dive! Escorts have spotted us and are turning to attack! Rig to run silent."



"0700 Hours. Depth charged for one hour. Some minor damage, but repair parties at work. Destroyer propeller noises receding. We'll come to periscope depth for our return punch."



"0715 Hours. Torpedo tubes 1, 2, 3 fired. Two destroyers hit and sinking. One of the enemy's last cargo ships coming into 'scope view — an ideal target position. On my mark... Fire Tube 4! Fire 5!"



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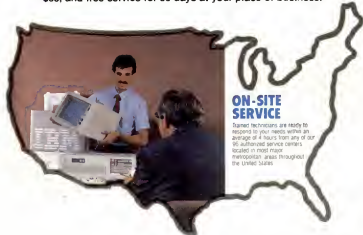
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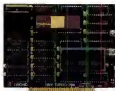
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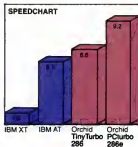
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LESSON ONE, PART ONE *Be creative! Avoid the obvious!* Moving-bar and drop-down menus are great. But don't lull the user into a sense of false confidence by allowing him to select choices by using the cursor keys. Instead, force selection in a unique and unexpected way: *Microsoft Word* likes the Tab key.

Better still, make sure the Tab key doesn't always work. Pick something unusual to move the selection in special circumstances. *Microsoft Word* makes it the Spacebar—a perfect way to keep users from choosing too hastily.

And don't be a hidebound conformist when it comes to keys. *WordPerfect* uses the Esc key to control repetitive operations (rather than allowing escape from anything) and the PgDn and PgUp keys to move one physical page (rather than a mere screen) at a time through a document. Put on your thinking cap and we'll bet you can find even more fanciful functions for common keystrokes!

Eschew consistency, the hobgoblin of little minds. Where is it written that one key should always act the same way? *Word* uses the Esc key to let users exit from menus—except for the very top one. Its Backspace key works differently in overtype and insert modes. And in the overtype mode of *SideKick*'s NotePad, they can bang on the Enter key all they want, but they won't be able to add text past the last line. Users enjoy the refreshing note of surprise these subtle differences bring to workaday chores.

Pretty up your act with menus and borders that can't be turned off. A plain blank screen can get downright boring. You'd do well to surround it with the charming rules of *Microsoft Word* or the block characters of *SAMNA* and *Framework*. And be sure to include big, attractive menus. They'll tastefully occupy space that would otherwise be filled with the user's unruly entries.

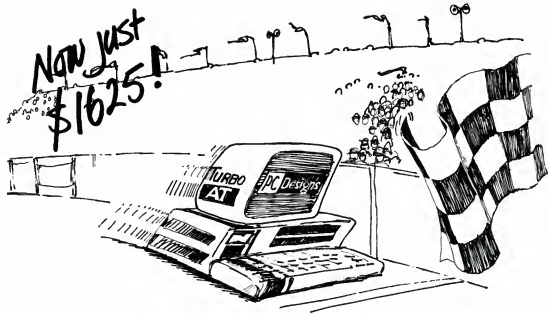


Use plenty of inverse video. Low-intensity text is hard to read next to bright inverse video, forcing the user to concentrate more intently on the work at hand. Best of all, inverse video that appears in the same place every single time eventually causes "phosphor burn," leaving the screen with an afterimage that'll subtly remind the user of your product—even when the machine is turned off! It works for Lotus; put it to work for you.

Don't worry about speed. All those superfast 386 machines are just around the corner. There's no sense compromising your program just to make it run on older models. Besides, everybody knows that 8088 machines are only for temporary clerical help, who can be counted on to be slower than any program you hand them—even *SAMNA* or *WordStar 2000*.

LESSON ONE, PART TWO *Don't offer automatic backup.* Neither DOS, BASIC, nor Lotus will save previous versions of your work without effort. Take a tip from the three most popular programs in PC history and don't bother wasting your time with this disk-cluttering feature. Whatever you do, don't offer automatic saves or the unheard-of option of retaining multiple-version backups (suffixes .BA1, .BA2, etc.) just because a few programmers, writers, and accountants claim they'd kill for such a feature. There's no need to include these wimps' violent tendencies.

Include a quick and easy way to destroy work by accident. Let users experience the horror of computerized destruction so that they don't fall into the trap of excessive



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complacency. There's no need for any program to keep track of whether the user has modified a file or is about to trash it by accident; if he can't be careful, he doesn't belong at the keyboard. *1-2-3* is exemplary, offering two instant wipeouts: the ever-popular /QY trash-it-all exit and the subtler but equally effective /FR<Enter>. Both provide highly instructive lessons on saving data early and often.

What is done must not be undone. Sure, some programs offer undo keys and even multilevel undo procedures. But that's kid stuff for the temporary help. Real users prefer the psychological realism of programs like *WordStar* and *1-2-3*, where big mistakes, as in real life, are often utterly irreversible.

Don't kill all the bugs too early. This strategy worked brilliantly for Borland, which issued nearly as many versions of *SideKick* as Baskin-Robbins has flavors. And everybody got a good chuckle out of the screwed-up first release of *1-2-3*, Version 2.0. Users who require dental work to repair their tooth-gnashing frustrations over early problems will hail a functional edition as a gift from the gods. After that experience, they're not likely to stray to someone else's brand-new product.

Leave something out of the box. Why should a user return the registration card without an incentive? Do what Ansa does with *Paradox*: withhold an essential part of the program (in Ansa's case, the applications generator) until the card comes back. If you avoid referring to the missing portion anywhere in the manuals (as Ansa does), those who don't return the card aren't likely to be any the wiser, anyway.

Charge extra for the manual the user really needs. Software isn't bundled with hardware. Why should it be bundled with complete instructions? IBM saw the light when it released DOS 2.1 with a manual that omitted all the interesting stuff from the 2.0 edition. The user can always buy the *DOS Technical Reference* manual if he really wants it. And Microsoft Press stands ready to sell books on a whole range of Microsoft products. Moral: always look at documentation as a profitable secondary market.

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Michael J. Miller INFOWORLD

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1998	~5
1999	~10
2000	~10
2001	~35
2002	~25
2003	~45
2004	~65

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■ STEWART ALSOP

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I'm mad and I'm not going to take it anymore.

What I'm mad about is the arrogance of most of the world's programmers, those people who create the code that ends up in the programs we use in our PCs. These people seem to think that we have an unlimited amount of time to learn the programs they write and an unlimited amount of either brain space or desk space to keep track of their ways of doing things. They also seem to work on the principle that each of their programs is the only one we use.

I should admit here that I'm not like most computer users, since I tend to get a massive overdose of programmer's arrogance. I have about 15 megabytes of program code on my hard disk, which includes four word processors, two spreadsheets, perhaps a dozen memory-resident utilities (I can't really remember how many), two desktop publishers, three file managers, 4 or 20 laser printer fonts (depending on how you define a font), a couple of laser-printing utilities, three DOS utilities, about half-a-dozen EGA utilities, four communications programs, and, yes, a couple of games. And that doesn't include the waiting line of some two dozen programs that I will take a look at any day now or the 50 to 60 programs that sit on my shelf because I just can't get up the motivation to play around with them and find out how they work.

NONSTANDARDS I know that most of you don't have more than half-a-dozen programs on your hard disk, since you

have to actually pay for them. But I'm sure that every user out there has had an experience similar to mine. Have you ever encountered a program that decided the F1 key should be used for something besides help? How about one that used the Esc key for something besides backing out of submenus? Have you ever tried out a new word processor, only to discover that this one decided to make insert mode the default, instead of overstrike, mode like the word processor you know and are frustrated with? Have you ever forgotten what the "hot keys" were for your pop-up notepad or spreadsheet annotation program?

Why are programs like this? Because their creators, with all-too-few exceptions, are arrogant as hell. A few columns back (Volume 5 Number 10), I described entrepreneurial arrogance and how it helps and hurts companies. Programmer's arrogance, however, is a different animal altogether.



I've been studying this phenomenon for some time now, and I suppose such arrogance has something to do with the process of learning how to program. The first time you write a program it's usually some little ditty to write "Hello" on the screen. That's not too hard, but as you get more adventurous, you begin to discover that there are a lot of things the computer doesn't like you to do. Then you develop an attitude that the computer should like to do what you want it to and that you'll teach it to do those things come hell or high water. Eventually your attitude transfers to users of computers, who will damn well learn how to use your program whatever they might be accustomed to using.

WON'T DO WINDOWS Where programmer's arrogance becomes most visible is in response to new integrated operating environments such as *Microsoft Windows*. Whether they like *Windows* or not, every programmer has an opinion about it and about standardized operating environments in general. Some recent comments I've heard include: "Those people at Microsoft don't know anything about graphics"; "There are obviously better ways to make menus"; and "Why didn't the developers let you use memory-resident programs?"

In other words, virtually every programmer I've met believes he or she could have done a better job than Microsoft at making *Windows*, despite the fact that it took Microsoft nearly 3 years (and Lord only knows how many hundreds of man-years) of development to create *Windows*.

■ STEWART ALSOP

And most of these arrogant programmers are determined to make absolutely certain that their programs don't make the same mistakes.

So most of these guys are designing

their programs with their own interfaces. And guess what? Each one is different from all the others. That means that each person who buys one of these programs is going to have to learn yet another way of

saving a file, cutting data out of a file, editing data, and other tasks common to every program of every type. This will happen regardless of the fact that one of the major objectives of a program like *Windows* is to give you a standard way of interacting with programs so that you don't have to learn a whole new set of commands every time you want to do something new.

WORDLY WAYS I don't know about you, but I'm getting madder than hell and I wish I didn't have to take it anymore. I've learned the so-called Lotus interface (I've even used Slash File Save in my dreams). I've learned the so-called PFS-style interface (and was amused when Symantec let you use PFS selection keys, even though they don't appear on Q&A's screen). I've learned several variations on the so-called

■ Virtually every programmer I've met believes he or she could have done a better job than Microsoft at making *Windows*.

Framework-style interface (which uses function keys to drop down menus). I have to admit to being one of the few writers in the world who have never touched *WordStar*'s interface (I just can't handle Ctrl-KB Ctrl-KK just to define a block of text).

I'm almost getting mad enough to refuse to use another new program that doesn't take advantage of what I already know. I say almost because I'm really a junkie for new software. I get my kicks by seeing a program do something I didn't think programs could do. Unfortunately, there seem to be a lot of people like me: they used to call us suckers. And that lets programmers stay as arrogant as they've always been. As they say, there's a sucker born every minute.

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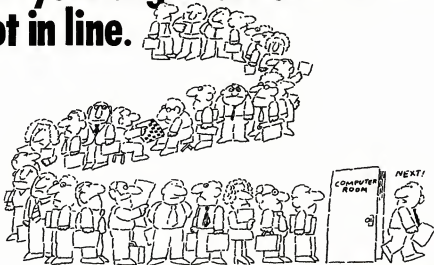
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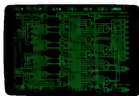


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PC Magazine Labs' third annual printer survey has added 97 new machines to our growing body of comprehensive reviews. The newest printers show some incremental technology improvements, but precious little true innovation.



97 new printers that we tested in this issue will have to compete for your attention with the 70 printers reviewed last year, and a record 120 in 1984—almost all of these older models are still available.

The 97 new printers that we tested will have to compete for your attention with the 70 printers reviewed last year, and a record 120 in 1984.

To help you navigate through the sea of 287 printer reviews that PC Magazine has published in these 3 special issues, this year we've added an index. The index, located at the end of the review section, refers you to the correct volume, issue, and page number for each printer review contained in this issue, as well as the reviews published in the previous 2 years.

We've organized this special issue to reflect both printer technology and price (printers are listed in ascending price order). The first section reviews dot matrix and ink jet printers. It is the largest of the review sections, with prices ranging from \$149.95 to over \$2,300. Next comes a section on laser printers and, finally, a section on daisy wheel printers. The printer guide, found at the end of this introductory section, contains key test results and is organized in the same fashion.

This year, printer technology improvements were incremental. Many printers now feature convenient LED and LCD buttons on their front panels that often replace DIP switches and menus for controlling printer settings and setting features. Color is becoming standard, and 24-pin printers are better than ever, but they're still noisy. Some new lasers are cheaper; others are better but more expensive.

TESTING THE PRINTERS

Our veteran reviewers used some improved, but still compatible, versions of our tried-and-true PC Magazine Labs printer tests.

An experienced team of reviewers (many of whom are veterans of all preceding printer issues) tested the printers in PC Magazine Labs using the latest editions of our printer test programs. These programs have become something of an industry standard. Several printer vendors now have copies of these programs and use them to test their products before they are introduced. Like all PC Labs test programs, the printer tests are available through the PC Magazine Interactive Reader Service electronic bulletin board.

PC Labs printer test programs check for the printer character set's compatibility with the IBM PC, test the printer's features, produce a quality sample that shows a variety of printer features, and run speed tests that measure the printer's effective, or net, throughput speed. In addition, the reviewers always run a sound test during the speed test. You can find the test results, including the print quality samples, in the printer guide charts.

PC Labs printer test programs have been upgraded again this year but remain

fully consistent with earlier versions of the PC Labs programs. Thus, you can safely compare this year's results with results published in the two previous printer issues. The programming upgrades give laser printers a fairer speed test (by having them print 20 pages instead of 2 pages) and more extensively test each printer's text-printing compatibility with other popular printers.

In addition, Decision Resources (the company that produces *Chart-Master* and other PC graphics products) of Westport, Connecticut, supplied a graphics compatibility program to produce the PC Magazine logo. We've included printouts of the test in the printer guide—they are great for visual comparison of graphics quality.

You can find key test results for each printer in the printer guide chart. Reviewers' evaluations and subjective judgments on each printer are included in review articles. Each review is accompanied by a PC Magazine Fact File containing vendor and other pertinent information and by a photograph of the printer.—John Dickinson

SAME OLD, SAME OLD... While incremental change is better than nothing, more innovation would have been better. As printers went through the PC Magazine Labs testing mill, people would ask me how things look in the printer business this year. Mostly, all I could say was, "Same old, same old." Few of the printers you'll see reviewed in this issue deliver the type of technological or price/performance breakthroughs we've come to expect from printer designers.

That's a shame because the printer segment of the microcomputer industry, as you can see from the number of printers that we've reviewed in the last 3 years, is easily its most active and potentially most interesting one. Considering how competi-

tive this segment of the microcomputer industry is, it's surprising that the technological competition among printer vendors isn't fiercer.

NEW KIDS ON THE BLOCK As usual, this year a spate of new printer vendors you've never heard of, or at least never thought of as printer companies, are trying to make it big in the business. But only a few are trying to make their mark with innovative designs. For example, AT&T (you remember Ma Bell) is going after the high-grade 24-pin dot matrix printer market by adding color printing and easy print-feature programming that includes a front-panel LCD display to an otherwise basic design. The mighty (and American-made)



Output Technology Corp. machines come replete with three (count 'em, three) high-speed dot matrix printheads to reduce lateral printhead travel time and increase print speed (although not by nearly as

Brother's

Twinriter 5 includes both daisy wheel and dot matrix printheads so users can have the best of both impact printing technologies.

much as the manufacturer suggests). But most of the new companies are relying on knockoffs of older designs made by other vendors, and some are just remarketing printers made by Japanese original equipment manufacturers (how many more versions of the Centronics GLP will we see?).

TRADITION REIGNS The more-traditional printer vendors seem satisfied to offer you minor upgrades to existing designs or to introduce models sporting printer technologies pioneered by other companies. Epson, for example, keeps upgrading its FX series with design "enhancements" that are so minuscule that you have to wonder what all the fuss is about. The best-known Japanese desktop dot matrix printer company has also started to take 24-pin dot matrix printers seriously with its new line of LQ printers priced under \$1,000—but that's hardly an innovation these days.

Okidata's Microline 292/293 series printers include 18-pin printheads, good performance, and color capability. That all sounds good and innovative, until you realize that the 18-pin design is merely a hardware version of the two-pass software logic Okidata has used to produce correspondence-quality printing for years, or until you realize that Okidata's color capa-

OUR REVIEWERS

Bruce Brown is a principal at Soft Industries, a Connecticut computer consulting firm. He is the founder of the Connecticut Computer Society and has taught business uses of computers at various area colleges.

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Gretchen Luchsinger is a former summer intern at *PC Magazine*. She is currently a student at Barnard College.

Charles Petzold is a contributing editor of *PC Magazine*. He writes the PC Tutor column and frequently contributes to the Programming/Utilities and the Power User columns. Petzold also worked on the two previous printer projects.

John Phillips is technical director for Five Technologies, a human resources consulting firm located in Woodcliff Lake, New Jersey.

Alfred Poor is a principal of Soft Industries and a frequent contributor to *PC Magazine*.

Vincent Puglia writes frequently for *PC Magazine*. He has edited for several newsletters and is now a free-lance consultant.

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Tony Rizzo is assistant director of information technologies at New York University School of Continuing Education. He specializes in data processing, office automation, personal-computer training, and curriculum development. He serves as a personal-computer consultant for the Division of Career and Industry Programs, SCE.

M. David Stone is a frequent contributor to *PC Magazine* and has contributed to both previous printer issues. He is a free-lance consultant specializing in computer communications and has written three computer books.

Phil Wiswell is a free-lance writer based in New York. He writes frequently for *PC Magazine* and runs a computer consulting business.

bility is incompatible with any other color printer on earth. They're good printers, but hardly innovative.

A few machines from traditional vendors are notable for their innovative design. Brother's Twinriter 5, for example, includes both daisy wheel and dot matrix printheads so users can have the best of

both impact printing technologies. The printer works well in either mode and switches without the slightest complaint.

LASER CONFUSION Laser printers present a confusing picture because the new machines, regardless of the manufacturer's previous history, offer both innova-

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It's an animated simulation of the PC's microprocessor that lets you see with your own eyes how assembly language works. You'll be using it as a debugging tool for years to come.

It's a tutorial. A lot of people think the 350 page manual is the best book on assembly language ever written.

It's 45 demonstration programs you'll execute with the simulator, from simple register loads to advanced programs that manipulate interrupts and perform file I/O. And what you'll learn applies to all 86 family processors, including the 80186 and 80286. **\$79.95** not copy protected

The Visible Computer for IBM PC/XT/AT and true compatibles. If your dealer doesn't have it, order direct: Software Masters, 2714 Finleather, Bryan, TX, 77801. (409) 823-9490. Please include \$3.00 shipping. Bank cards accepted.



TVC takes you inside the processor as it executes programs.

Software Masters™



PRINTERS

tive and traditional design elements. Several (most, in fact) new laser printers give users relief from the mediocre ergonomics of the laser engine that Canon cobbled to-

This year's market may not sport the most-inspiring printers, but there sure are a lot of them to choose from.

gether from its copier business 2 years ago. They use the superior laser engine designs from Ricoh, Mita, Hitachi, and other (Japanese, please note) engine manufacturers. Xerox, of course, uses its own (and very innovative) engine that can be equipped with a copier option.

These new laser engines were designed from the start to be printers, not copiers. As a result, they offer easier, more-reliable, and more-capacious paper handling than the Canon engine. Many of the new engines are also smaller than the Canon, and even those that aren't take up less total desk space because of their better paper-handling designs. They are not, however, any faster than the Canon, nor is their resolution (300 dots per inch) any better.

These printers' laser controllers (the built-in computers that control what a laser printer actually does) leave much to be desired. Most of the laser vendors have opted to compete with Hewlett-Packard's original Laserjet design philosophy by offering line printing capabilities that are, at heart, the same thing (albeit usually with a wider selection of fonts) you can get from any self-respecting daisy wheel printer.

Some models, including HP's new Laserjet Plus, add graphics capabilities, but usually not full-page graphics; these graphics are often incompatible with any other printer or plotter graphics. As a result, the only advantages of most laser printers over a high-quality daisy wheel printer are faster, quieter printing and

(with some printers, at least) a wider selection of character fonts and sizes.

If you want to take advantage of the advanced graphics and desktop publishing capabilities that are touted as the best features of laser printers, you're stuck with Apple Computer's LaserWriter or LaserWriter Plus, or QMS's PostScript printer, all of which come with Adobe Systems' PostScript page description language (PDL). New PostScript models from Texas Instruments are due out next year.

One reason for the paucity of laser controllers with advanced capabilities is the lack of PC software to run them. Only a few word processors, page makeup, and graphics programs that run on a PC can take advantage of either PostScript or the subset of Xerox's InterPress PDL that is included in the 4045 controller. The other reason is that licensing the Adobe or Xerox PDLs, and the fonts that go with them, is expensive and adds a considerable premium to the unit cost of a laser printer. Several software companies are committed to changing the PC software situation within the next year, and, as lasers and other nonimpact page printers proliferate, the unit cost of page description software should come down.

One laser printer cost that does seem to have come down (it's impossible to get hard information, but this is a well-founded guess) is the original Canon engine. At least one laser printer vendor is passing that cut on to you—QMS's Kiss (for Keep It Simple, Stupid) printer offers excellent fonts, along with Diablo and Epson (including graphics) compatibility, all for a mere \$1,995. That should make you think twice about spending more than \$4,000 for a Ricoh-based printer that offers the same, or lesser, capabilities.

PLENTY OF CHOICES This year's market may not sport the most-inspiring printers, but there sure are a lot of them to choose from, and plenty of good, sound choices among them. You shouldn't have any trouble finding just the printer you're looking for, even if you have to check back to last year's issue to find it.

John Dickinson is editor of Computers in Banking magazine and is a contributing editor of PC Magazine.

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PERSYST
EMULEX

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The PC Magazine Printer Guide



PC Magazine's Printer Guide provides data pertinent to your printer purchase decisions. Results come from PC Magazine Labs benchmark tests and hands-on evaluations.

PRINT QUALITY

To allow you to judge text and graphics print quality, text samples are shown both in their actual size and enlarged four times. The graphics sample—the PC Magazine logo—was created with a program custom-designed by Decision Resources of Westport, Connecticut. The program was compatible with a wide range of popular printers, but not all. Therefore, we've noted whether printers with no samples shown are unable to print graphics or are incompatible with our tests.



SPEED:

Rated speeds were obtained from the manufacturer. Default refers to tested speed in draft mode and quality to tested speed in near-letter-quality mode. For dot matrix and daisy wheel printers, speed was tested for a two-page run. The IBM Proprinter XL has a typical dot matrix speed of 119 characters per second. Forty-one cps, the speed for two of the Editor's Choice daisy wheels, is usual for that type of printer. Laser speeds are measured in pages per minute, with the HP Laserjet 500 Plus clocking in at a representative 8.0 ppm.

TYPE PITCHES

To give you a point of reference, 10 characters per inch is typical pica type, 12 cpi is typical elite, and 17 cpi is typical condensed mode.

FEATURES

Listings of each printer's printing and formatting features tell you how far beyond plain vanilla printing it will go.



PRINTING FEATURES

- H Horizontal emphasis (bold)
- V Vertical emphasis (double strike)
- C Correspondence quality
- U Underline
- S Sub/superscript
- R Red ribbon

FORMATTING FEATURES

- P Proportional spacing
- J Justified lines
- C Centered lines
- LH Variable line heights
- FL Variable form length
- HT Horizontal tabs
- VT Vertical tabs

Dot Matrix — \$150 to \$299

PRODUCT	TYPE CARRIAGE WIDTH PRICE	SPEED: Characters per second	TYPE PITCHES: Characters per inch	FEATURES: Printing Formatting	SOUND LEVEL: Decibels	COMPATIBILITY: IBM char. set Graphics Text
 Laptop Syst	Thermal transfer	40 rated 15 default	5.0 10.0 10.0 20.0	H U	55-64	 EpiMX
Does not support graphics.	50Turns on E	6.625 in.		LH FL HT VT		EpiMX
	Slide. <i>Quattro</i>	\$150				

Ergo Systems Hush 80PR



hush80: Power
wer On Default.
ult. expan
ed type.
wer On Default.

Thermal transfer
80 rated
31 default
5.0
10.0
20.0
6.625 in.
\$200

<56-60
LH HT VT
OtiML82
EpiMX

General Electric 3-8100



GE 3-8100:
lt. Power On
r On Default
ult. Power
wer On Defau
ault. Pow

Thermal transfer
50 rated
20 default
15 quality
5.0 13.0
9.0 14.0
10.0 15.0
11.0 20.0
12.0
11 in.
\$260

U S
NA 61
LH HT VT
EpiFX30/35,
MX; 10MXc, Pro
EpiMX, 10MPro

Brother M-1109



Brother M-11
Letter Quali
Under 1
10.5 in.
\$299

Impact matrix
100 rated
53 default
15 quality
5.0 10.0
8.0 12.0
8.5 17.0

C U S
60-70
P LH FL
HT VT
EpiFX, JX, MX
EpiMX80

SOUND LEVEL

Sound level doubles for each 10-decibel increase under real-life conditions. The average printer pounds away at 72 decibels, indicated by a rule on the graph. Compare that to the 20 decibels of rustling leaves, the 50 decibels of the average office, or the 120 decibels of a rock concert. The blue bar shows the rated decibel level.

The orange bar shows the measured decibel level.



COMPATIBILITY

The Printer Guide reports on each printer's character compatibility with IBM's low (ASCII code 0-127) and high (ASCII code 128-255) order character set. Low-order characters represent the letters, numbers, and symbols found on the keyboard. The high-order IBM display characters include some line- and box-drawing characters that are useful for nongraphics drawing programs.

Low-order characters



High-order characters



If your printer emulates (is compatible with) the text or graphics of a printer that your applications program supports, you'll have no trouble printing your output. We've tested for each printer's emulation of many of the more-common printers.

DP8050	..... DataProducts 8050 Color Printer
D630	..... Diablo 630
Ep (CX, FX, FX80, FX85, FXseries, JX, LX, MX)	..... Epson
EpLQ	..... Epson LQ-1500
HPLJ	..... Hewlett-Packard Laserjet
HPLJ+	..... Hewlett-Packard Laserjet Plus
IBMGr	..... IBM 5152 Graphics Printer
IBM5162	..... IBM 5162 Color Printer
IBMPro	..... IBM Proprinter
NSp	..... NEC Spinwriter
OnIML (82, 84, 192)	..... Okidata Microline
PanIKX-P1091/2	..... Panasonic IKX-P1091, P1092
QS11+	..... Qume Sprint 11 Plus
Tek	..... Tektronix 4695
TI (855, 857)	..... Texas Instruments
X2700	..... Xerox 2700

Dot Matrix — \$299 to \$349

PRODUCT

TYPE
CARRIAGE
WIDTH
PRICE

SPEED:
Characters
per second

TYPE
PITCHES:
Characters
per inch

FEATURES:
Printing
Formatting

SOUND
LEVEL:
Decibels

COMPATIBILITY:
IBM char. set
Graphics
Text

RCA VP2100



Qm

RCA VP2100 D
ault. Underl
Near Letter
On Default.
sized. Near
\$299

Impact
matrix
(9 pins)

100 rated
51 default
15 quality

10.0
12.0
15.0

HVCUS

<60 71

EpFX80/85, MX

P J C L H
FL HT VT

EpMX

Seikosha SP-1000



Qm

Seikosha SP-
e. double-st
. double-str
boldface. c
boldface. dc
\$299

Impact
matrix
(9 pins)

100 rated
51 default
14 quality

10.0
12.0
17.0

HVCUS

\$2 66

EpFX, MX

P L H FL HT

EpFX, MX;
IBMPro

Panasonic KX-P1080



Qm

Panasonic KX
rtional Spaci
lte. Underlin
acters. Ital
hasis Mode.
\$319

Impact
matrix
(9 pins)

100 rated
73 default
20 quality

5.0 10.0
8.0 12.0
7.5 15.0
8.5 17.0

HVCUS

60 73

EpFX, MX; Pan-
KX-P1091/2

P J C L H FL
HT VT

EpMX

Star NX-10



Qm

Star NX-10:
mphasized. B
tional. Propo:
Underline.
ality. Propo:
\$349

Impact
matrix
(9 pins)

120 rated
74 default
10 quality

5.0 10.0
8.0 12.0
8.4 16.3

HVCUS

NA 81

EpFX, MX;
IBMPro

P L H FL
HT VT

EpFX, MX

Dot Matrix — \$379 to \$595

PRODUCT	TYPE CARRIAGE WIDTH PRICE	SPEED: Characters per second	TYPE PITCHES: Characters per inch	FEATURES: Printing Formatting	SOUND LEVEL: Decibels	COMPATIBILITY: IBM char. set Graphics Text
---------	------------------------------------	------------------------------------	--	-------------------------------------	-----------------------------	---

Star NL-10



Q.m

Star NL-10:
xt. Boldface
etter Qualit
uality. Powe
oldface type
Quality type

Impact
matrix
(9 pins)

9.5 in.

\$379

120 rated
72 default
18 quality

5.0 12.0
6.0 17.0
8.0

HVCUS

<60 dB



P FL HT VT

EpFX80/85,
MX; IBMGr
EpFXseries,
MS; IBMGr

Fortis DM2010



Q.m

dm 2010: Po
ower On Defa
ault, double
e strike. Po
ower On Defa
ult, double

Impact
matrix
(9 pins)

10.2 in.

\$459

200 rated
115 default
30 quality

5.0 12.0
6.0 17.0
10.0

HVCUS

NA 01



PLH

FL HT VT

EpFX, IBMPro

IBMPro

Diconix 150



Q.m

Diconix 150:
Double-Strike.
d. Power On Def
ke. *Italics.* u
Default. Empha
sized. Double

Ink jet

9.5 in.

\$479

150 rated
85 default
30 quality

10.0
16.0

HVCUS

45 62



LH FL HT VT

EpFX80/85, LX,
MX; IBMGr, Pro
N/A

Okidata Microline 192 Plus



Q.m

Okidata Micr
t. Near Lett
Emphasized P
raft. Power
Underlined.
to 601. 120

Impact
matrix
(9 pins)

9.5 in.

\$499

200 rated
105 default
36 quality

5.0 10.0
6.0 12.0
8.5 17.1

HVCUS

57 78



P J LH FL

HT VT

IBMGr

IBMPro

Brother M-1509



Q.m

Brother M-15
Emphasized
r Letter Qua
a. Emphasize
ar Letter Qu
to 601. 120

Impact
matrix
(9 pins)

16.125 in.

\$549

180 rated
70 default
26 quality

5.0 12.0
6.0 17.0
8.5 20.0
10.0

HVCUS

55 63



LH FL HT VT

EpFX, MX;
IBMPro

EpFX, MX;
IBMPro

Mannesmann Tally 85



Q.m

Mannesman-Ta
derlined tex
Near Letter
On Default.
Double-strik
ual N/A. Pow

Impact
matrix
(9 pins)

10.5 in.

\$549

100 rated
08 default
28 quality

10.0
12.0
17.0

HVCUS

<55 dB



P J C LH FL

HT VT

EpFX, MX;
IBMPro

EpFX, MX;
IBMPro

Facit 4513



Q.m

Facit 4513:
l Bold. Powe
d. Power On
wer On Defau
n Default. E
ult. Bold

Impact
matrix
(9 pins)

11 in.

\$595

160 rated
91 default
25 quality

10.0
12.0
17.0

HVCUS

57 79



PLH FL








HT VT

EpFX80/85,
LX, MX; IBMGr
EpMX

PRODUCT

PRODUCT		TYPE CARRIAGE WIDTH PRICE	SPEED: Characters per second	TYPE PITCHES: Characters per inch	FEATURES: Printing Formatting	SOUND LEVEL: Decibels	COMPATIBILITY: IBM char. set Graphics Text	
Olivetti DM280								
		Olivetti DM280: Impact matrix (9 pins)	180 rated 82 default 27 quality	10.0 12.0 17.1	H V C U S	<60 71		
		er Quality. n Default. N Emphasized. ality. Under \$595	9.5 in.		P L H F L H T V T		EpMX, IBMGx, Pro EpMX, IBMPro	
Fortis DM2015								
		dm2015: Power On Default.	200 rated 102 default 37 quality	5.0 12.0 6.0 17.0 8.5	H V C U S	NA 83		
		phasized. Power On Default emphasized. \$599	17.2 in.		P L H F L H T V T		EpFX, MX; IOBMPro EpFX, FX; IBMPro	
Fujitsu DX2200								
		Fujitsu DX2200: ult. Power On Defaul fault. Power ower On Defa	Impact matrix (8 pins, color) 220 rated 105 default 20 quality	10.0 17.1 12.0 20.0 15.0	H V C U S R	<55 74		
		\$645	18 in.		P L H F L H T V T		IOBMGr, Pro IBMGx, Pro	
Juki 5510								
		Juki 5510: nt. Double-Strike. Power ouble-Strike . Power On D	Impact matrix (9 pins, color) 180 rated 82 default 15 quality	5.0 10.0 6.0 12.0 8.5 17.0	H V C U S	NA 70		
		\$648	9 in.		P L H F L H T V T		IOBM5102 IBMGx	
C-Itch C-310 XP								
		C.Itch C-310 ult. Elite Le: Elite Italic p nal Quality P tter Quality. l	Impact matrix (9 pins) 300 rated 157 default 29 quality	10.0 12.0 17.1	H V C U S	55 68		
		\$649	10.25 in.		P L H F L H T V T		EpFX, IOBMPro EpFX, IBMPro	
Okidata Microline 292								
		Okidata 292: Quality. Italic rlining. Power ty. Italics. En ne. Power On D	Impact matrix (10 pins, color) 240 rated 132 default 80 quality	5.0 10.0 6.0 12.0 8.5 17.0	H V C U S R	57 75		
		\$699	10.5 in.		P J L H F L V T		EpLX, IBMPro, OkiML102 IOBMPro	
Epson EX-800								
		Epson EX-800 : Italics. E Proportional. Default. Und ouble-Strike	Impact matrix (9 pins) 300 rated 115 default 43 quality	10.0 12.0 17.0 20.0	H V C U S	NA 77		
		\$749	13.5 in.		P L H F L H T V T		EpFXB0/BS, LX, MX; IBMGr, Pro EpMX, IOBMPro	

Dot Matrix — \$749 to \$819

PRODUCT	TYPE CARRIAGE WIDTH PRICE	SPEED: Characters per second	TYPE PITCHES: Characters per inch	FEATURES: Printing Formatting	SOUND LEVEL: Decibels	COMPATIBILITY: IBM char. set Graphics Text
Okidata Microline 193 Plus						
	Okidata Microline 193 Plus. Near Letter Quality. Emphasized Type. Power On Default. \$749	Impact matrix (9 pins) 200 rated 105 default 36 quality	5.0 10.0 6.0 12.0 8.5 17.1	HVCUS PJLH FL HT VT	55 73	IBMGr IBMPro
Printronix P1013 Pers. Line Ptr.						
	Printronix P1013. Underline. Bold. Elite. Underline. Power On Default. \$795	Impact matrix (line printer) 134 rated 99 default 42 quality	10.0 12.0 17.1	HVCUS PLH FL HT VT	57 80	EpLQ; IBMGr, Pro IBMPro
Epson FX-286						
	Epson FX-286. Double Strike. Near Letter Quality. Draft Mode. Default. \$799	Impact matrix (9 pins) 200 rated 105 default 26 quality	10.0 12.0 17.2 20.0	HVCUS PJLH FL HT VT	64 77	EpFX, MX; IBMPro IBMPro
Epson LQ-800						
	Epson LQ-800. Italics. Dots. Elite. Underline. Emphasized. Power On Default. \$799	Impact matrix (24 pins) 160 rated 105 default 52 quality	5.0 12.0 6.0 15.0 7.5 17.1 8.5 20.0 10.0	HVCUS PJLH FL HT VT	68 79	EpFX80/85, MX,LQ EpMX, IBMPro
IBM Proprinter XL						
	IBM Proprinter XL. Core. Emphasized. Proportional. Underscore. Proportional. Underline. \$799	Impact matrix (9 pins) 200 rated 119 default 65 quality	5.0 10.0 6.0 12.0 8.8 17.1	HVCUS PLH FL HT VT	60 79	IBMGr IBMGr
Seikosha MP-1300AI						
	Seikosha MP-1300AI. Double. Quality. Proportional. Power On Default. Underline. \$799	Impact matrix (9 pins, color) 300 rated 119 default 41 quality	10.0 12.0 17.0 20.0	HVCUS PLH FL HT VT	<59 73	EpFX80/85, JX, LX, MX; IBMGr, Pro EpMX, IBMPro
C. Itoh C-315 XP						
	C. Itoh C-315 XP. Quality Type. Proportional Spacing. Elite Print. Quality Type. Proportional Spacing. \$819	Impact matrix (9 pins) 300 rated 150 default 30 quality	10.0 12.0 17.1	HVCUS PLH FL HT VT	65 73	EpFX, MX; IBMPro EpFX, MX; IBMPro

Dot Matrix — \$899 to \$995

PRODUCT

TYPE
CARRIAGE
WIDTH
PRICE

SPEED:
Characters
per second


TYPE
PITCHES:
Characters
per inch


FEATURES:
Printing
Formatting

SOUND
LEVEL:
Decibels

COMPATIBILITY:
IBM char. set
Graphics
Text

Genicom 1020





Genicom 1020
Impact matrix
(18 pins)
Print. Quality.
Double-Strike
nt. Underline
er On Default
\$899


15.75 in.

200 rated
111 default
74 quality

10.0
12.0
15.0
17.0


HVCUS


<60 74



EpFX, JX; D630;
IBM5182, Gr
EpFX, JX; D630;
IBM5152, Gr

Okidata Microline 293





Okidata 293:
Quality. NLG
Underline. P
t. Near Lett
d & Emphasiz
\$899


16 in.

200 rated
123 default
80 quality

5.0 10.0
6.0 12.0
6.5 17.0


HVCUS


57 74



EpFX, LX, MX;
IBMPro
IBMPro

TI 857





TI 857: Pow
ter Quality.
Shadow. Bold
over On Defa
y. Underline
d. Letter Q
\$899


11 in.

150 rated
96 default
31 quality

10.0 16.7
12.6 20.0
15.0


HVCU


63 79



EpFX80/85, MX
EpMX, D630

Panasonic KX-P1595





Panasonic KX
Letter Quali
Elite Pitch. B
h. 17 Pitch I
ear Letter Qua
letter Qualit
\$949


17 in.

240 rated
123 default
42 quality

5.0 10.0
6.0 12.0
7.5 15.0
8.5 17.0


HVCUS


66 79



EpFX, IBMGr
EpFX, MX; D630

ALPS P2000





Near Letter
phasized. Do
g. Power On
er Quality.
Double-Strik
Default U
\$995


16.5 in.

250 rated
130 default
39 quality

5.0 10.0
6.0 12.0
8.5 17.0


HVCUS


<56 73



EpFX80/85,
MX; IBMGr, Pro
EpMX, IBMPro

Epson EX-1000





Italics. E
Proportional.
Default. Und
ouble-Strike
er Quality.
Letter P
\$995


15.875 in.

300 rated
119 default
44 quality

5.0 12.6
6.0 17.2
10.0 20.0


HVCUS
R


NA 77



IBMGr
IBMGr

NEC Pinwriter P7





NEC Pinwrite
uality Type.
Enhanced Its
optional Type
er On Default
\$995


16.75 in.

216 rated hs
111 default hs
160 rated reg
99 default reg
49 quality

10.0 17.0
12.0 20.0
15.0

HVCUS

56 70



EpLQ
EpLQ

Dot Matrix — \$999 to \$1,295

PRODUCT	TYPE CARRIAGE WIDTH PRICE	SPEED: Characters per second	TYPE PITCHES: Characters per inch	FEATURES: Printing Formatting	SOUND LEVEL: Decibels	COMPATIBILITY: IBM char. set Graphics Text
---------	------------------------------------	------------------------------------	--	-------------------------------------	-----------------------------	---

Mannesmann Tally 290



Qm

Mannesmann T
erscore. Emp
Q. Power On
NLQ Mode. Em
Underscore. \$999

Impact
matrix
(9 pins)
200 rated
133 default
36 quality

5.0 10.0
6.0 12.0
7.5 17.1
8.5 20.0

H C U S
P J C L H
F L H T V T

60 79



EpFX, IBMGr

EpMX, IBMPro

TI 865



Qm

TI 865: Pow
Bold. Letter
ow Printing.
Default. Sha
ty. Power On
Letter Qual \$999

Impact
matrix
(9 pins)
150 rated
96 default
31 quality

10.0
12.0
15.0
20.0

H V C U
P J L H F L
H T V T

62 77



EpFX80/85,
MX; TI865, 867

EpMX,
IBMPro, D630

Centronics Printstation 260



Qm

Centronics P
lt. Emphasiz
t. Power On D
ault. Emphas
ed. Power On
efault. Pow \$1,095

Impact
matrix
(9 pins)
200 rated
104.6 default
34.5 NLQ

5.0 10.0
6.0 12.0
6.6 13.3
7.7 15.0
8.4 16.6

H V C U S R
P J L H
F L H T V T

60 68



EpFX, MX;
IBMS182, Gr

EpMX, D630

Epson LQ-1000



Qm

Epson LQ-100
g. Italics.
rtional. Elite.
ault. Underl
mphasized. P
to. Power On \$1,095

Impact
matrix
(24 pins)
100 rated
105 default
52 quality

5.0 12.0
6.0 15.0
7.5 17.1
8.5 20.0
10.0

H V C U S
P J C L H
F L H T V T

60 79



EpFX80/85,
MX, LQ

EpMX, IBMPro

Brother



Qm

Brother Twin
Double str
fault. Bold.
Power On Def
underline. P
Auto \$1,295

Impact
matrix
(9 pins,
daisy wheel)
140 dm rated
77 dm default
54 dm quality
36 dw rated
34 dw default
13 dw quality

10.0
12.0
15.0

H C U S
P L H F L
H T V T

<60 72



EpFX85, MX;
IBMPro

D630

Brother



Qm

Brother 2024
print. Under
e print. Proj
efault. Draf
int. Emphasi
Auto \$1,295

Impact
matrix
(24 pins)
150 draft
71 default
52 quality

10.0
12.0

H V C U S
P J C L H F L
H T V T

<65 82



EpFX80/85

D630;
EpFX80/85

Fortis DH



Qm

mode. Power On
ower On Default
Default. shadow
shadow print
w print mode. \$1,295

Impact
matrix
(9 pins and
daisy wheel)
140 dm rated
76 dm default
36 dw rated
31 dw quality

10.0
12.0
15.0

H V C U S
P L H F L
H T V T








<60 71



EpFX

EpFX
IBMPro

Dot Matrix — \$1,295 to \$1,595

PRODUCT	TYPE CARRIAGE WIDTH PRICE	SPEED: Characters per second	TYPE PITCHES: Characters per inch	FEATURES: Printing Formatting	SOUND LEVEL: Decibels	COMPATIBILITY: IBM char. set Graphics Text
Tandy DMP-2110						
	Qm Tandy DMP 2110: Courier, Emphasized, Underline, Near Letter Quality, Proportional Shadow, Bold. Price: \$1,295	Impact matrix (24 pins) 15.875 in.	240 rated 123 default 62 quality	5.0 18.0 8.8 12.8 8.3 18.7	HVCUS 60-74	IBMGr, Pro; IBMGr, Tan
Okidata Microline 294						
	Qm Okidata Microline 294: Near Letter Quality, Emphasized, Underline, Proportional Shadow, Bold. Price: \$1,374	Impact matrix (18 pins) 17 in.	400 rated 182 default 77 quality	5.0 18.8 6.0 12.8 8.5 17.0	HVCUS NA 73	EpJX, IBMGr IBMGr
Fujitsu DL2400						
	Qm Fujitsu DL2400: Shadow, Bold, Proportional Shadow, Bold. Price: \$1,395	Impact matrix (24 pins, color) 16.75 in.	218 rated 111 default 56 quality	18.8 12.0	HVCUS <55-74	EpFX, JX, MX; IBMGr, Pro EpMX, IBMPro, D630
Star NB-15						
	Qm Star NB-15: Emphasized, Bold, Near Letter Quality, Underline, Proportional Shadow, Bold. Price: \$1,449	Impact matrix (24 pins) 15.5 in.	300 rated 199 default 60 quality	8.8 18.0 8.0 12.8 8.5 17.8	HVCUS 63-83	EpFX85, MX EpMX
Genicom 3210						
	Qm Genicom 3210: Emphasized, Bold, Near Letter Quality, Underline, Proportional Shadow, Bold. Price: \$1,495	Impact matrix (9 pins) 16 in.	240 rated 164 default 36 quality	5.8 18.8 8.8 12.0 8.8 13.1 7.5 15.0 8.3 16.5 8.6 17.0	HVCUS 62-80	IBMPro, OkuML84 IBMPro
ALPS P2100						
	Qm ALPS P2100: Near Letter Quality, Emphasized, Bold, Underline, Proportional Shadow, Bold. Price: \$1,595	Impact matrix (18 pins) 16.5 in.	400 rated 173 default 55 quality	5.8 18.8 6.0 12.0 8.5 17.8	HVCUS <55-73	EpFX80/85, MX; IBMGr, Pro EpMX, IBMPro
Epson LQ-2500						
	Qm Epson LQ-2500: Emphasized, Bold, Near Letter Quality, Underline, Proportional Shadow, Bold. Price: \$1,595	Impact matrix (24 pins, color) 15.875 in.	270 rated 104 default 57 quality	5.0 12.0 6.0 15.0 7.5 17.2 8.5 20.0 10.8	HVCUS NA 79	EpFX, JX, MX, LQ; IBMGr EpSeries

Dot Matrix — \$1,595 to \$1,849

PRODUCT

TYPE
CARRIAGE
WIDTH
PRICE

SPEED:
Characters
per second

TYPE
PITCHES:
Characters
per inch

FEATURES:
Printing
Formatting

SOUND
LEVEL:
Decibels

COMPATIBILITY:
IBM char. set
Graphics
Text

IBM Quietwriter Model 2



Qm

IBM Quietwriter Model 2
Underlining.
Power On Default.
Underlining. Power On Default.

Thermal transfer
15 in.
\$1,595

40 rated
28 default

Variable

U S

<50 db



IBMGr, Pro

EpMX

P LH FL HT VT

Nissho NP-910



Qm

Nissho NP910
Double-Strike
Power On Default.
Underlining.

Impact matrix (9 pins)
15.875 in.
\$1,595

350 rated
150 default
34 quality

10.0
12.0
15.0
18.0

H V C U S

59 78



EpCX, FX80/85, MX; IBMGr, Pro

EpMX, IBMPro

LH FL HT VT

AT&T 477



Qm

AT&T 477 (Derivative Mode)
Double-Strike
Power On Default.
Double-Strike.

Impact matrix (24 pins, color)
18.75 in.
\$1,695

288 rated
144 default
100 NLQ
75 quality

10.0 17.0
12.0 18.0
15.0 20.0

H V C U S

55 72



IBMPro

IBMPro

P LH FL HT VT

NEC Pinwriter P5XL



Qm

NEC Pinwriter P5XL
Quality Type
12 CPI Type
Strike Type
Power On

Impact matrix (24 pins, color)
16.75 in.
\$1,695

290 rated
123 default
240 rated
119 default
50 quality

10.0 17.0
12.0 20.0
15.0

H V C U S

53 72



EpFX, JX, LQ, MX

EpFX, LQ, MX

P J C LH FL HT VT

Toshiba P351C



Qm

Toshiba P351C
lite. Courier
italics. Prescriptions.
Power On
er. Proportion

Impact matrix (24 pins, color)
16 in.
\$1,749

240 rated
120 default
65 quality

5.0 10.0
8.0 12.0
8.4 20.0

H V C U S

60 72



IBM5162, Gr

IBMPro

P LH FL HT VT

Nissho NP-2410



Qm

Nissho NP2410
Quality. E
Double-Strike
n Default. N
rtional. Emphas

Impact matrix (24 pins)
16.25 in.
\$1,845

300 rated
164 default
99 quality

10.0
12.0
15.0
18.0

H V C U S

59 77



EpFX80/85, LQ, MX; IBMGr, Pro

EpMX, IBMPro

P LH FL HT VT

Seikosha BP-5420AI



Qm

Seikosha BP-5420AI
e. double-
Default. bold
fault. bold
fault. bold

Impact matrix (8 pins)
10 in.
\$1,849

417 rated
216 default
133 quality

10.0
12.0
18.0
20.0

H V C U S

55 78

















EpFX, IBMGr

EpFX, MX; IBMPro

P LH FL HT VT

Dot Matrix — \$1,850 to \$2,199

PRODUCT		TYPE CARRIAGE WIDTH PRICE	SPEED: Characters per second	TYPE PITCHES: Characters per inch	FEATURES: Printing Formatting	SOUND LEVEL: Decibels	COMPATIBILITY: IBM char. set Graphics Text
JDL-750e	 Qm	JDL 750e: P ics. Empha On Default. Double-Strik line. Itali \$1,850	Impact matrix (24 pins, color) 180 rated 102 default 74 quality	10.0 17.1 12.0 20.0 15.0	HVCUSR PJCLH FL HT VT	60 81 	▼ EpFX80-85, JX, MX; IBM5182, GcPro D630, EpMX
Infoscribe 800	 Qm	Infoscribe 8 Corresponden Near Letter Power On Def ality. Corre \$1,895	Impact matrix (9 pins) 200 rated 108 default 35 quality	10.0 12.0 10.5	HVCUS PLH FL VT	<70 84 	▼ N/A N/A
OT-700e	 Qm	Output Techn fault. enpha pica. Power ica. Power O ca. Power On \$1,995	Impact matrix (9 pins, triple head shuttle) 700 rated 185 default 70 quality	5.0 10.0 0.0 12.0 8.3 10.8	HCU PLH FL HT VT	<70 83 	▼ EpFX, IBMPro EpFX
OT-700n TriMatrix	 Qm	OT700n: Pow asized. Doub ubscript. Po hasized. Dou Subscript. P \$2,095	Impact matrix (27 pins) 700 rated 192 default 44 quality	5.0 12.0 0.0 18.0 10.0	HVCUS LH FL HT VT	<70 88 	▼ EpFX, MX; IBMGr EpMX, IBMPro
DataProducts 8070 Plus	 Qm	Dataproducts ining. Empha efault. Unde ke. Power On d. Double-St \$2,099	Impact matrix (16 pins) 400 rated 192 default 58 quality	10.0 12.0 17.1	HVCUS PJLH FL HT VT	65 72 	▼ ▲ DP8050, IBM5182, Gr EpMX, IBM Pro
Printek FormsPro 2000	 Qm	Printek Form eutive Qual d Print, Sha ype. Power C e. Proportional \$2,195	Impact matrix (18 pins) 200 rated 111 default 53 quality	10.0 12.0 13.3 18.7	HVCU PLH FL HT VT	65 78 	▼ N/A D630
Mannesmann Tally 490	 Qm	Mannesmann T ble Strike. er Quality. Emphasized. Power On Def \$2,199	Impact matrix (13 pins) 400 rated 247 default 123 quality	5.0 10.0 8.0 12.0 7.5 15.0 8.6 17.1	HCUS PJCLH FL HT VT	55.4 67 	▼ ▲ EpMX, IBMGr EpMX, IBMPro

Dot Matrix — \$2,295 to \$2,795

PRODUCT

TYPE
CARRIAGE
WIDTH
PRICE

SPEED:
Characters
per second

TYPE
PITCHES:
Characters
per inch

FEATURES:
Printing
Formatting

SOUND
LEVEL:
Decibels

COMPATIBILITY:
IBM char. set
Graphics
Text

Genicom 3310 Color



Qm

Genicom 3310
Processing F
ke (shadow)
rlined lette
letter quali
\$2,295

Impact
matrix
(8 pins,
color)
16 in.
\$2,295

300 rated
123 default
89 quality

10.0 15.0
12.0 16.7
13.1 18.0

H V C U S
P J C L H F L
H T V T

82 78

IBM5182

EpMX

TI 880 AT



Qm

texas instru
shadow print
10cpi.
10cpi. Power
Power On Def
On Default.
ault. shadow
\$2,295

Impact
matrix
(9 pins)
19.5 in.
\$2,295

300 rated
172 default
78 quality

5.0 10.0
6.0 12.0
8.0 18.0

H V C U S
L H F L H T V T

65 74

IBMPro

IBMPro

Hermes PC-4



Qm

uality. Powe
On Default.
Quality. Pow
On Default.
Quality. Pow
On Default.
\$2,350

Impact
matrix
(18 pins,
color)
17 in.
\$2,350

400 rated
173 default
79 quality

10.0
12.0

H C U S R
P L H F L
H T V T

52 79

EpFX, IBMGr

EpMX, IBMPro

Lasers — \$1,395 to \$2,795

PRODUCT

TYPE
CARRIAGE
WIDTH
PRICE

SPEED:
Characters
per second

TYPE
PITCHES:
Characters
per inch

FEATURES:
Printing
Formatting

SOUND
LEVEL:
Decibels

COMPATIBILITY:
IBM char. set
Graphics
Text

Oasys Jato Card



Qm

Jato Card:
ld. Times R
mes Roman B
Default. Tir
c. Power On
Power On
\$1,395

Laser
8 rated
8.56 default
N/A
\$1,395

Variable

H V C U S
P L H F L
H T V T

N/A

EpFX, HPLJ,
HPLJ+

EpFX, HPLJ+,
D630

QMS Kiss



Qm

QMS KISS Eps
. Underline.
ne. Power Or
On Default.
t. Bold. Unc
Underline E
\$1,995

Laser
8.0 rated
7.4 default
8.5 in.
\$1,995

7.0
10.0
12.0
16.7

H V U S
P L H F L
H T V T

<55 64

EpFX, MX

EpFX, MX;
D630; Q811+

The Blaser



Qm

GTC Blaser:
ning. Power
ower On Def
Default. Bo
. Bold. Und
Underlining
\$2,795

Laser
8.0 rated
8.7 default
8.5 in.
\$2,795

5.0
10.0
16.7

H U S
P L H F L
H T V T

55 63

IBMGr, Pro

IBMPro

Lasers — \$2,795 to \$4,495

PRODUCT

TYPE
CARRIAGE
WIDTH
PRICE

SPEED:
Characters
per second

TYPE
PITCHES:
Characters
per inch

FEATURES:
Printing
Formatting

SOUND
LEVEL:
Decibels

COMPATIBILITY:
IBM char. set
Graphics
Text

Qume LaserTEN



Qm

QUME LaserTEN
g. Power On Def
ault. Underli
ning. Power
On Default.
24-pin dot

Laser
10.0 rated
8.8 default
8.5 in.
\$2,795

Variable

H U

50 62



HPLJ, HPLJ+

P LH FL
HT VT

HPLJ, HPLJ+

Cordata LP300 Desktop Printshop



Qm

Corona LP300:
int Font. Band
ld Italic. Ca
fault. Taylor
Font. MX Medi
um

Laser
8.1 rated
5.9 default
5.9 quality
8.5 in.
\$2,995

6.3
9.4
12.5
16.8
Variable

H V U S

<55 <60



EpMX

P J LH FL
HT VT

EpMX

CIE LIPS 10



Qm

CIE LIPS 10
Default. Und
italic. Power
old. Boldfac
erline. Medi
um

Laser
10.0 rated
8.0 default
8.5 in.
\$3,495

Variable

H V U S

<55 <60



EpFX, MX,
HPLJ+

P LH FL
HT VT

EpFX80/85,
MX; D630; HPLJ

DEC LN03

Graphics are incompat
ible with our tests.

Qm

DEC LN03: F
h proportional spac
es Roman with pr
in Default. 1
cing. Power On
nportional spac
ing

Laser
8.0 rated
7.4 default
7.4 quality
8.5 in.
\$3,495

10.0
12.0

U

<56 63



N/A

P LH FL
HT VT

N/A

LaserImage 2000

Beta version of graph
ics software was
incompatible with our
tests; an improved
version should be
available soon.

Qm

Power On Def
erscore. Pow
Power On Def
ault. Bold
Bold, under
lined

Laser
8.0 rated
7.45 default
7.45 quality
8.5 in.
\$3,495

10.0
12.0
13.0

H V U S

NA 63



HPLJ

P J CLH
FL HT VT

D630

QuadLaser



Qm

Quadram Quad
is boldfaced
. This is it
onal print with a
n Default. T
underlined

Laser
8.0 rated
7.3 default
8.5 in.
\$3,795

8.0 14.0
10.0 16.0
12.0 18.0

H U S

NA 63



EpFX, MX;
HPLJ+

P LH FL HT
VT

EpFX, MX;
QS11+; HPLJ

QMS ConceptWriter

Graphics are incompat
ible with our tests.

Qm

QMS ConceptW
r Bold. Ital
Reverse Imag
d. Italic. I
se Image. I

Laser
8.0 rated
3.0 default
2.8 quality
8.5 in.
\$4,495

Variable

H

<55 <60



Text

LH FL HT
VT

D630

Lasers — \$4,995 to \$5,999

PRODUCT

TYPE
CARRIAGE
WIDTH
PRICE

SPEED:
Characters
per second

TYPE
PITCHES:
Characters
per inch

FEATURES:
Printing
Formatting

SOUND
LEVEL:
Decibels

COMPATIBILITY:
IBM char. set
Graphics
Text

AST TurboLaser



Qm

AST TurboLaser
d. Double-Str
r On Default
erline. It
zed. Double-
zed. On Defau

Laser
8.0 rated
7.5 default
8.5 in.
\$4,995

5.0 12.0
6.0 20.0
10.0

H V U S
P J C L H
FL HT VT

55 64
EpFX 80/85,
MX; IBMGr, Pro
EpMX,
IBMPro, D630



HP LaserJet 500 Plus



Qm

HP LaserJet 500+
Times Roman Bol
lic. Power On Def
erline. Times Ron
. Times Roman B
lic. Power On D

Laser
8.0 rated
7.4 default
8.5 in.
\$4,995

5.0 10.0

U S
LH FL HT
VT

55 <60
HPLJ, HPLJ+
HPLJ, HPLJ+



Oasys LaserPro 810-R



Qm

lt. Boldface: i
erline. Power On
hadowed Boldfaw
. Boldface. Sh
line. Power On
and Boldface

Laser
8.0 rated
7.5 default
7.4 quality
8.5 in.
\$4,995

Variable
H V U S R

<55 <60
P L H FL
HT VT

EpFX, MX;
HPLJ+
EpFX, MX; D630;
HPLJ+; Q8T1+



Xerox 4045 Laser CP



Qm

Xerox 4045 L
rline. Bold.
r On Default
etics. Titan. P
old. Courier
ult. Underl

Laser
10.0 rated
9.2 default
9.2 quality
8.5 in.
\$4,995

10.0 12.0
15.0
Variable

H U S
P J C L H
FL HT VT

55 <60
X2700, D630
X2700, D630



QMS PS-800



Qm

QMS PS-800:
ld. Shadow.
d. Shadow. F
. Shadow. Pc
Shadow. Powe
hadow. Power

Laser
0.1 rated
5.17 default
8.5 in.
\$5,899

Variable
H V U S

<55 <55
P J C L H
FL HT VT

N/A
D630



TI OmniLaser 2015



Qm

TI Omnilaser
1B207331362E374016.
1B207331362E3740ep1
Power On Def
r On Default
Default. Mod

Laser
15.0 rated
7.1 default
7.1 quality
8.5 in.
\$5,995

10.0 12.0
16.7

H V U S
P J C L H
FL HT VT

55 <60
T1055
D630, HPLJ,
T1055



Apple LaserWriter Plus



Qm

Apple LaserW
Italics. Cou
Bold. Helvetica
Times-Roman B
Σμμβολ. Couri
Courier Bold

Laser
6.0 rated
0.0 default
0.0 quality
8.5 in.
\$5,999

Variable
U S

NA <60
P L H HT VT

D630













Graphics are incompati-
ble with our tests.

Graphics are incompati-
ble with our tests.

Lasers — over \$7,000

PRODUCT	TYPE CARRIAGE WIDTH PRICE	SPEED: Characters per second	TYPE PITCHES: Characters per inch	FEATURES: Printing Formatting	SOUND LEVEL: Decibels	COMPATIBILITY: IBM char. set Graphics Text
Imagen Innovator ImageStation	Laser	8.0 rated 7.0 default	8.0 12.0 9.0 15.0 10.0 20.0	H V U P J L H FL HT VT	<55 <60	<div>   </div> <div>  </div> <div> EpFX, MX; IBMGr EpFX, MX; IBMGr; D630 </div>
 <div> Qm Imagen Image <u>lining</u>. <u>Bol</u> <u>ault</u>. <u>Underl</u> <u>wer On Defau</u> <u>inting</u>. <u>Power</u> <u>Shadow Print</u> </div>	0.5 in.	\$7,200				

Daisy Wheels — \$499 to \$699

PRODUCT	TYPE CARRIAGE WIDTH PRICE	SPEED: Characters per second	TYPE PITCHES: Characters per inch	FEATURES: Printing Formatting	SOUND LEVEL: Decibels	COMPATIBILITY: IBM char. set Graphics Text
Cosmo World Adeus CP2000	Fully formed	22 rated 20 default 9 quality	10.0 12.0 15.0	H U P J C L H FL HT VT	<58 72	<div>  </div> <div>  </div> <div> N/A D630 </div>
Does not support graphics. Qm COSMO WORLD . <u>Auto Under</u> . <u>Double Sti</u> <u>uto Under sco</u> <u>ouble Strike</u> <u>Underline</u>	13.875 in.	\$499				
Olympia ESW 1000C	Fully formed	14 rated 13.3 default 8.0 quality	10.0 12.0 15.0	H V U S P J L H FL HT VT	60 70	<div>  </div> <div>  </div> <div> N/A D630 </div>
Does not support graphics. Qm Olympia ESW Print. <u>Double</u> . <u>Bold Print</u> <u>n Default</u> . <u>N</u> . <u>Underlined</u> <u>Strike</u>	14.7 in.	\$549				
Fortis DX25	Fully formed	22 rated 22 default	10.0 12.0 15.0	H V U R P L H FL HT VT	60 71	<div>  </div> <div>  </div> <div> N/A D630 </div>
Does not support graphics. Qm Fortis DX25: <u>acing</u> . <u>Underlin</u> <u>-Strike</u> . <u>Power</u> <u>ing</u> . <u>Underlining</u> <u>rike</u> . <u>Power On</u> <u>Underlining</u>	15.5 in.	\$645				
Facit D2000	Fully formed	27 rated 25 default 10 quality	10.0 12.0 15.0	H V U P J C L H FL HT VT	<58 68	<div>  </div> <div>  </div> <div> N/A D630 </div>
Does not support graphics. Qm Facit D2000: . <u>Power On</u> <u>efault</u> . <u>Shad</u> <u>ow Print</u> . <u>Power</u> <u>wer On Defau</u> <u>Shadow Print</u>	14 in.	\$695				
IBM Wheelprinter E	Fully formed	18 rated 18 default 10 quality	10.0 12.0 15.0	H U S P L H FL HT VT	61 79	<div>  </div> <div>  </div> <div> N/A N/A </div>
Does not support graphics. Qm IBM Wheelpri <u>sis Print Mo</u> <u>ult</u> . <u>Emphasi</u> <u>er On Defaul</u> <u>rike</u> . <u>Power</u> <u>Shadow Print</u>	15 in.	\$699				

Daisy Wheels — \$799 to \$1,899

PRODUCT	TYPE CARRIAGE WIDTH PRICE	SPEED: Characters per second	TYPE PITCHES: Characters per inch	FEATURES: Printing Formatting	SOUND LEVEL: Decibels	COMPATIBILITY: IBM char. set Graphics Text
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Olympia ESW 2000C

Does not support graphics.	Qm	Olympia ESW line. Bold. C Underline. B ault. Underl On Default. B ault. On Def	Fully formed 20 rated 22 default 17 in.	10.0 12.0 15.0	H V U P L H FL HT VT	58 70 N/A D630
			\$799			

Qume LetterPro Plus

Does not support graphics.	Qm	QUME Letter Pr rline. Two-str our-strike Bol e Bold. Power ike Bold. Thre d Shadow Cha	Fully formed 45 rated 41 default 22 quality 12 in.	10.0 12.0 15.0	H V U S LH FL HT VT	<59 75 N/A D630
			\$899			

C. Itoh StarWriter D10-40

Does not support graphics.	Qm	C. Itoh D10- rscore Mode. nt Mode. Pro t. Auto Unde . Shadow Pri	Fully formed 35 rated 31 default 14 quality 16 in.	10.0 12.0 15.0	H V U S P J C LH FL HT VT	<60 70 D630 D630
			\$999			

Fujitsu SP320E

Does not support graphics.	Qm	Fujitsu SP32 . Shadow Pri On Default. . Proportional. Shadow Print	Fully formed 48 rated 41 default 16.75 in.	10.0 12.0 15.0	H V U P J C LH FL HT VT	55 70 N/A D630
			\$1,495			

Olivetti DY450

Does not support graphics.	Qm	Olivetti DY4 ng. Boldface ult. Underli Power On Def drow Printing	Fully formed 55 rated 43 default 10 in.	10.0 12.0 15.0	H V U S P J C LH FL HT VT	61 72 N/A D630
			\$1,499			

Primage 100

	Qm	Primage 100: Proportional. B n Default. U Shadow Print ng. Proportio	Fully formed 100 rated 57 default 16 in.	10.0 12.0 15.0	H V U S P J C LH FL HT VT	57 77 EpFX, MX EpMX, D630
			\$1,895			

Olivetti DY800

Does not support graphics.	Qm	Olivetti DY ring. Boldfa wer On Defau ortionall print rscoring. Bc	Fully formed 98 rated 55 default 20 quality 17 in.	10.0 12.0 15.0	H V U S P J LH FL HT VT	60 78 N/A D630
			\$1,899			

There's nothing standard about this corporate standard.

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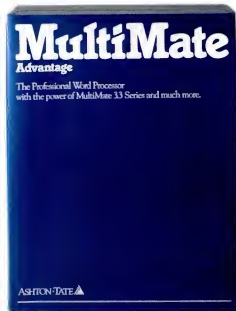
It also supports a new 40,000-word thesaurus. As well as a 110,000-word dictionary (complete with medical and legal jargon), which you can easily customize to include your own frequently used words.

And if you still need more reasons why this corporate standard isn't standard, look no further than MultiMate Advantage's keyboard. It's been specially designed just for word processing.

For the name of your nearest authorized

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It's the first word processing program good enough to live up to everyone's standards.



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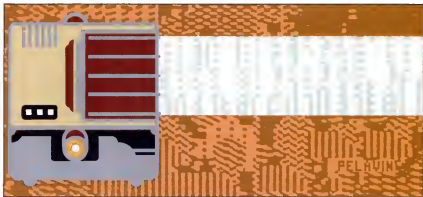
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JOHN DICKINSON

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better, speedier, tougher, and
cheaper than ever.



PC EDITOR'S CHOICE

The low-end dot matrix printer market is almost entirely limited to unremarkable Epson clones, but the \$299 RCA VP2100 stood out from the crowd. The VP2100 is similar to the 2-year-old Centronics GLP but also has 12-pitch printing and the ability to use combinations of features. We liked the Centronics well enough to give it the Editor's Choice back then, and we like the improved version even better.

Twenty-four-pin dot matrix printers have been around awhile, but not at the prices Epson is asking for the Epson LQ-800 and the wide carriage Epson LQ-1000. The \$799 LQ-800 is one of the first 24-pin dot matrix printers for under \$1,000. A little more built-in IBM compatibility would have been nice, but the print quality is exquisite. Nothing else came close in terms of price and performance.

We could say that the \$1,295 Brother Twinriter 5 is in a class by itself, except that Fortis sells the identical printer as the \$1,295 Fortis DH-45. By either name, this combination daisy wheel and dot matrix printer offers an intriguing solution for those who need both true letter quality and graphics output.

A primary virtue of dot matrix printers is their speed, and the \$2,199 Mannesman Tally 490 is far and away the fastest dot matrix printer in the bunch. It has a highly readable 247-cps draft mode and a 123-cps near-letter-quality mode. It's also built with an apparent ruggedness that's rarely matched.

We saw more color dot matrix printers than we expected, but, like their predecessors, the color ink-jet printers of 2 years ago, none stood out from the crowd as an Editor's Choice. Perhaps the color lasers when they come...

more. Dot matrix printers have always been, and continue to be, the workhorses in most offices, and there's no reason to believe that their role is going to change any time soon.

Today's dot matrix printers are generally good-quality machines that are inexpensive, easy to use, and very reliable. Even the lowest-cost 9-pin models offer acceptable printing speeds, and many of them offer more-than-passable correspondence-quality printing. Some dot matrix printers are so inexpensive that corporate users consider them disposable—if they break down, they are junked and replaced instead of repaired.

The higher-cost 24-pin printers produce variable-font, correspondence-quality print that will fool all but the most-discerning readers into thinking it was produced by a daisy wheel or laser printer. Premium-grade 9-pin printers offer the welcome kind and combination of speed and durability that would warm the heart of many a minicomputer user.

Since PC Magazine has reviewed most of the printers introduced in previous years in the last two printer issues, we review only the newest models in this dot-matrix roundup. No matter what you think your price range is, be sure to look through all the reviews to find just the right dot matrix printer. You may find a low-priced model that will do the job for you, or you may decide to spend a few more dollars for some extra features you find attractive.

—John Dickinson

Laptop Systems On the Go

The little guy in this year's pack of printers is the Laptop Systems On the Go thermal printer. This 2½-pound (including four C-cell batteries) bantamweight isn't as powerful as the major players, but it's just right for laptop users who have a few extra inches of space in their shoulder bags. And it costs just \$149.95.

The On the Go is easy to set up and use. The printer comes with the DB 25S serial cable, so all you have to do is plug it in and go. Loading paper is simple too. The On the Go has a friction-feed and won't handle paper wider than 8½ inches; inserting pa-

PC FACT FILE



Laptop Systems On the Go

Laptop Systems Inc.

515 Calle San Pablo

Camarillo, CA 93010

(800) LAP-TOPP

(805) 482-9699

List Price: \$149.95; optional accessory kit, \$29.95

Dimensions (HWD): 1.77×11.22×4.57 in.

Weight: 2.5 lbs.

Made in Japan

In Short: Small, easy-to-use thermal printer for laptop applications with a serial interface. A good buy.

CIRCLE 628 ON READER SERVICE CARD

per is as easy as putting it in the slotted rear and pushing the feed button. There's another button to reverse the feed, a power switch, on- and off-line buttons, a low-battery light, and an alignment button on the top front panel.

Special features include compressed, enhanced, and underlined type, variable line spacing, and expanded modes. The standard draft print face is very dot-matrix-like and difficult to read. The On the Go supports 72- by 72-bit mapped graphics, but you need some BASIC savvy to take advantage of this feature.

The On the Go is quiet, but it should be with its snail-like pace. In PC Magazine Labs benchmark tests it dawdled along at 20 characters per second in draft mode (Laptop Systems claims 40) and 14 cps in enhanced mode. The On the Go uses thermal technology—another drawback. Thermal paper is hard to find and expensive, and it smudges when touched or crinkled—and all computer paper is apt to get crunched up during travel. However, Laptop Systems sells thermal paper in plastic-protected sheets or rolls, alleviating this problem to some extent.

If you really want to use this printer on the go, I'd suggest buying the optional ac-

cessory kit (\$29.95), which gives you a black plastic carrying cover, a roll of thermal paper, an AC adapter, and a battery protector.

Despite its slow speed, the On the Go's virtues are its portability and low cost. In particular, this printer is good for people who need hard copies on the fly and don't need wonderful print quality.

—Christopher Johnston

Ergo Systems Hush 80PR

"Big on features!" shouts the headline on an Ergo Systems Hush 80PR brochure. By the time I finished testing this printer, all I was shouting was a disappointed, "Big deal!" "Little deal!" would have been more apropos, considering the printer's only real features are low price, low noise, and small size.

My first minutes with the Hush 80PR were marked by nothing but frustration. After half an hour of loading the paper—otherwise called tugging and ripping the required roll of thermal paper—I realized that the manual's instructions for loading paper were incorrect. The drawing demonstrating paper feeding barely resembles what you see in the printer. Although I fixed the paper and breathed a sigh of relief, manual interpretation problems continued to crop up throughout the testing.

OK. So, for \$199.95, what do you get? While the printer looks a bit like a dented shoebox, it's compact and as light as a heavy feather. The whole package, including paper and battery, weighs less than 3 pounds. A rechargeable internal battery ensures portability.

Fantasies about stashing my Hush 80PR in a briefcase and running off to far-away places ran through my mind—that is, until I started the printer's self-test. The print quality (draft mode only) was so poor that my eyes crossed while trying to read it. I saw only dots, no descenders. Also, the Hush 80PR plods along at a mere 30 characters per second.

All four character modes (standard, condensed, expanded, and inverse) are only accessible using control codes. And I encountered difficulty in switching between modes; for example, I was stuck in

inverse type for over three pages.

Yet all was not lost. Low sound level stands out as the Hush 80PR's most distinctive feature—so low it could not even be detected by the PC Magazine Labs sound meter. The printhead glides over the lines with a sound like a muffled purr. The Hush 80PR is not eligible for the library but definitely appropriate on an airplane or wherever else your fancy suits you.

At first glance, another plus is the Hush 80PR's miniature size. While this feature makes the printer ideal to carry in a briefcase, I nevertheless worry about survival under duress. The cover over the paper had no latch to keep it closed, and the paper roll fell out several times while I just moved the printer about on the table. You don't want to open your briefcase and find 40 feet of paper scrambled inside, and the wobble of control buttons under your touch is definitely not reassuring.

As for compatibility with other printers, this little printer didn't seem to get along with anyone except the Okidata Microline 82A in graphics mode. After failing to reproduce any of the IBM high-level characters, the Hush 80PR flunked the PC Labs text compatibility test, even

though the manual assured me that the printer is compatible with the Epson MX-100. But when I called Ergo Systems and was instructed to turn to Table D-1, I saw a statement that the Epson codes are not actually implemented. So even considering the Hush 80PR's price range and noise level, its disadvantages and the availability of better machines in this class make me warn, "Look before you leap!"

—Gretchen Lachsinger

General Electric 3-8100

If you're willing to wait for it, GE's new printer, the small, quiet GE 3-8100, delivers fine-quality type and very clear graphics. The GE 3-8100 is a thermal transfer printer that operates either without a ribbon (when you have to use special thermal paper) or with a thermal wax ribbon (when you're using standard copier paper).

Setting up this printer is quite simple; there's not much to do other than put in the ribbon (if you're going to use plain paper), attach a parallel printer cable, load the paper, plug the printer in, and start printing. The GE 3-8100 can use single-sheet or 9½-inch fanfold paper. It has no tractor-feed or pin-feed mechanism, and so keeping fanfold paper straight is difficult—after just a few pages, the paper shifts. The manual recommends lining the paper up directly behind the printer, but this technique is not reliable. Roll paper brackets are also included.

The printer has only three DIP switches, located just under the dust cover. The switches control paper detection, 7- or 8-bit signal reading, and carriage-return/line-feed characteristics. You can access the printer's other features either by using front-panel switches or through programming. You select letter quality, referred to as "normal" print, with a front-panel switch. A sliding switch controls character density. It also would be nice to be able to use software for these tasks, but the printer doesn't allow you that option. You can, however, use programming to select underlined, superscript and subscript, and elite type, as well as double and compressed type. Programming can also control line-feed, graphics, and function codes.



Ergo Systems Hush 80PR

Ergo Systems
303-3 Convention Way
Redwood City, CA 94063
(415) 363-5966
List Price: \$199.95
Dimensions (HWD): 2.8×11.6×5.5 in.
Weight: 3 lbs.
Made in U.S.A.

In Short: A thermal dot matrix printer that combines briefcase portability with a minimum sound level at below-average speed and print quality.

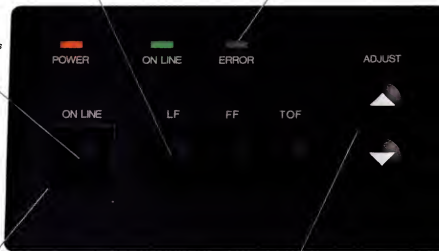
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General Electric 3-8100
General Electric Co.
Electronics Pkwy., Bldg. #5
Syracuse, NY 13221
(800) 626-2000
List Price: \$259.95
Dimensions (HWD): 3.8×14.5×11.1 in.
Weight: 10 lbs.
Made in Japan

In Short: A small, quiet, slow, only-some-what-IBM-compatible, and nearly unsupported printer intended primarily for use in the home.

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The GE 3-8100 passed our text and graphics compatibility tests, acting just like the IBM Graphics Printer, IBM Proprinter, and Epson FX series printers on each of the tests. But GE's printer does not print the PC's higher-order character set; in fact, it crashed while testing for high-order characters.

The best that can be said about the GE 3-8100 is that it is very quiet (only 61 decibels) and its quality type looks very good. The sound and quality come at too steep a price in speed, however. The 3-8100 is extremely slow, in both draft and letter-quality modes. While the printer is rated at 50 characters per second in draft mode and 25 in letter-quality mode, we rated it at only 19.5 and 14.5 cps, respectively. With the GE 3-8100, printing a two-page letter becomes an opportunity to leave the room on a short (but longer than quick) errand.

The Commodore, Atari, and IBM PCjr are the only computers the manual mentions directly as being compatible with this printer. That raises the problem of support—important for a printer intended for use with home computers like those.

When I called the GE Answer Center for information about pricing and factory rating of noise levels, the pleasant customer service representative told me that the printer is "very quiet" and that there is no factory list price, pricing being determined by dealers.

Of the five dealers in New York that according to GE carried the printer, three weren't in the telephone book. A fourth wouldn't tell me on the phone whether they carried the printer or not; the last said they didn't carry any GE printers. So although the GE 3-8100 is quiet and produces decent type and graphics, its poor speed and near-nonexistent support make me want to say, "Gee, GE, no thanks!"

—Bruce Brown

Brother M-1109

Fortunately, while the public is inundated with top-of-the-line claims for top-of-the-line printers, manufacturers at the low end of the spectrum have made a quiet yet effective effort to make better printers for those of us whose needs are simpler. One such manufacturer is Brother. Its latest effort has resulted in the Brother M-1109, a pixie-sized, \$299 printer offering a number of well-wrought features.

When taking the Brother M-1109 out of its carton and, setting it up, the first thing I noticed was that what Brother calls an "acoustical" cover is literally a piece of plastic that sits unhinged on top of the printer (or should it only it would stay on)—hardly an auspicious beginning.

But matters improved quickly. Setting the printer up turned out to be wonderfully simple. The entire process from carton to self-test took less than 10 minutes. During the self-test the printer adequately pulled through a sheet of paper using a friction-feed. Feeding paper a sheet at a time, other than for an occasional letter, is not a suitably routine task for the Brother M-1109, and I certainly wouldn't want to do it too often. A more reasonable method is to use Brother's fanfold pin-feed mechanism conveniently supplied with fanfold paper (a roll-paper option is also available). The pin-feed snaps on easily, has its own cover, and mercifully replaces the annoying acoustical cover. It didn't jam once.

The Brother M-1109's print quality is

better than I thought possible. The draft mode print, of course, looks like the standard 9-pin face. However, the near-letter-quality print looks remarkably good, good enough for home-based correspondence. Escape code sequences can enable a number of type variations, including enlarged, expanded, condensed, underlined, double-strike, superscript and subscript, and italics.

The M-1109's 15 characters per second in NLQ mode and 53 cps in draft mode are nothing to complain about especially considering its cost. Though its noise level was measured at 70 decibels, the Brother M-1109 assuredly wasn't a "noisy" printer. I found the quality of the noise acceptable; it made no annoying buzzes or unbearable screeches.

The Brother M-1109 is compatible with the IBM 5152 Graphics Printer and, in fact, did a really good job on the PC logo. The printer can handle bit-mapped graphics. Remarkably, the Brother performed exactly as it was supposed to, and the clear, concise manual reminds me of the excellent original Epson FX manual.

Overall, Brother is to be commended

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FACT FILE



Brother M-1109
Brother International
8 Corporate Pl.
Piscataway, NJ 08854
(201) 981-0300
List Price: \$299
Dimensions (HWD): 2.8×13.1×7.6 in.
Weight: 7.8 lbs.
Made in Japan
In Short: A basic 9-pin dot matrix printer that offers fairly good print quality and works well—especially considering its low price and small size.

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Computer Support Corporation
2215 Midway Road
Carrollton, Texas 75006
(214) 861-8960

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Diagram is a registered trademark of Computer Support Corporation.
IBM is a registered trademark of International Business Machines Corporation.

for the work it has done here. The Brother M-1109 deserves consideration from anyone looking for a basic home, small office, or travel printer, when size and price are the major considerations. It certainly stands out in the budget-minded ballpark it plays in.—Tony Rizzo

RCA VP2100

After you've renewed your passport, shopped at Banana Republic for the latest traveling attire, and put your mail on hold, you still won't be ready to take off—until you put an RCA VP2100 in your rucksack along with your PC-to-travel. This cute little printer will ensure that no matter how far you get from civilization, you'll still be able to write home about it.

Don't be fooled by the VP2100's small size and unimpressive looks: it's reliable, versatile, and easy to use whether you're in the Los Angeles office, on the road to Mandalay, or at the Timbuktu outpost. Your letters, memos, and reports will get high marks for looks, and you won't have to miss the boat waiting for the VP2100 to do its job—print speed is quite respectable at 50 characters per second in draft mode. Plus, the VP2100 runs at an easy-to-listen-to 68 decibels in its quieter mode.

The VP2100 has been around. We've seen it as the Centronics GLP, which Phil Wiswell called "an amazing, new 6-pound dot matrix wonder" when he reviewed it in *PC Magazine's* 1984 printer issue (Volume 3 Number 23). We've also seen its Brother version, to which reviewer Tony Rizzo gives kudos for its right-out-of-the-box willingness and energy to get your printing jobs done. *PC Magazine's* printer mogul John Dickinson slides the VP2100 into his luggage when he's on the go. And it's also a high performer back at the office, to which *PC Magazine's* editor, Bill Machrone, can attest. He uses it as an everyday workhorse. What better recommendations could you want?

The VP2100 is compatible with the Epson FX series and IBM printers. Its graphics are clean and true. In addition, its clear draft and sharp near-letter-quality print can compete with those of many larger, more expensive printers. The VP2100 produces elite and pica type, subscripts and super-



scripts, and enlarged and condensed print. You can get italics, underlined text, boldface and emphasized type, proportional print, near-letter-quality-print, and even combinations of print features like emphasized italic and proportional NLQ (improvements over the Centronics version Phil Wiswell reviewed in 1984).

Getting the printer up and running is simple: you just take it out of the box and plug it in. You can load the paper in the dark. My only gripe is that you must hold down the line-feed button (actually a blister on the touch-sensitive control panel) to advance the paper to the top of the form; I'd prefer to press, release, and, voila, have the paper advance. Also, we seem to have discovered a bug in the IBM graphics code. When the second DIP switch was set to On, for IBM graphics, we got some overwriting on our test script. But this annoyance is minor since you can use the bugfree Epson mode as well as the IBM mode for graphics.

The VP2100's manual, which clearly explains everything from DIP switches to foreign-character sets to troubleshooting (this topic gets less than a page—a good sign, no?), gets high marks. Although the

manual doesn't have an index, the sections are well laid out in the table of contents and it's easy to find what you need.

Unobtrusive, hardworking, portable, and versatile, the RCA VP2100 is a winner wherever it goes. Don't leave home without it.—Carol Olsen Day

Seikosha SP-1000

If you count yourself among the budget set, you'll want to look at the \$299 Seikosha SP-1000. This small, lightweight printer isn't fast, and it isn't fancy (though it does provide excellent near-letter-quality print), but it is affordable.

The SP-1000's best feature is the simplicity of its automatic paper loading. It takes just seconds to load forms. But while the forms never came close to jamming in my testing, the potential for jams is built in: the adjustable pin-feed sprockets may be slid to any position, but they do not lock onto the bar. Not only that, the sprocket hinges are so flimsy that you stand a good chance of snapping them off if you change the paper in a hurry.

Draft quality from the 9-pin printhead is roughly equivalent to that from the IBM 5152 Graphics Printer, but the NLQ mode is superb compared to other printers in this price range. I would not mind using the NLQ print for business correspondence.

Unfortunately, print quality comes at a high price in terms of speed. Rated at 100 characters per second in draft mode, the SP-1000 performs at only half that rate in actual use. Who would want to use its NLQ mode at only 14 cps? Graphics printing is even slower. If your work load keeps you pressed for time, don't even think about this printer.

Seikosha included the expected range of print enhancements with the SP-1000: boldface, shadow, underline, italics, NLQ, double width, sub- and superscript, and proportional spacing are all supported and easily accessed through Epson or IBM escape sequences. The manual provides thorough treatment, including examples, of all these codes. Thus, implementing the capabilities of this printer within different applications programs is straightforward. As far as your software is concerned, the printer is an Epson or an IBM.

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The

KX-P1080's printing capabilities overshadow any small problems you may find.

adequate, though it lacks an overall description of the printer's features, and it reads like a collection of technical appendices. But at least Seikosha left out the potatoes, not the meat.

All in all, the Seikosha SP-1000 offers no advantages over other dot matrix printers in its class. It's a low-cost printer and you get what you pay for. If you're not on a budget, you'll want a faster, more feature-filled, better-constructed printer.

—Phil Wiswell

Panasonic KX-P1080

A good, inexpensive printer is always welcome. The new Panasonic KX-P1080 is a cut-rate version of its excellent KX-P1091 that doesn't sacrifice the features or print quality of the original model. The only difference in the two machines is that the KX-P1080 is Epson-compatible, while the P1091 works in both Epson and IBM formats. (If you prefer an IBM-compatible printer, you can convert the KX-P1080 with an optional KX-P1080 ROM chip.)

The KX-P1080 comes in a serviceable casing that is virtually indistinguishable from dozens of similar Epson-type printers. A small switch on the left side of the front panel allows you to easily choose draft, near-letter-quality, or compressed type, while membrane-touch panels on the right deal with the on-line, form-feed, and the line-feed functions.

Examining the KX-P1080 was a lesson in ignoring first impressions. When I began to assemble the printer, I immediately noted several small irritants: the inconvenient paper guide, which for some reason comes in two separate pieces; the plastic tractor cover that flew halfway across the room the first time I tried to remove it; and the tractors which, by being situated in a position to pull the paper from the platen (rather than push it through), make it almost impossible to adjust the paper backward.

If you're easily startled, it may be a good idea to read the printer's instructions before you load the paper. The KX-P1080's platen automatically "catches" the paper as you insert it and pulls it over to the front of the roller. It's then up to you to pull it up to the tractors. A switch on the left side of the printer changes the platen



FACT FILE



Panasonic KX-P1080
Panasonic Computer Products Div.
Two Panasonic Way
Secaucus, NJ 07094
(201) 348-7000

List Price: \$319

Dimensions (HWD): 4.5×15.9×11.3 in.

Weight: 13.4 lbs.

Made in Japan

In Short: An excellent, slow-but-sure printer for most basic word processing and graphic uses with a good variety of fonts and type sizes.

CIRCLE 644 ON READER SERVICE CARD



FACT FILE



Seikosha SP-1000

Hanori Seiko Computer Peripherals

1111 MacArthur Blvd.

Mahwah, NJ 07430

(800) 422-7768

(201) 529-4655 (in N.J.)

List Price: \$299

Dimensions (HWD): 4.7×15.4×10.9 in.

Weight: 10.9 lbs.

Made in Japan

In Short: A low-cost but also low-speed dot matrix printer that, surprisingly, produces excellent near-letter-quality print.

CIRCLE 645 ON READER SERVICE CARD

The four membrane buttons and four LED lamps on the SP-1000's front panel for selecting print functions are a convenience I didn't expect to find on an otherwise low-end printer. In addition to the usual line-feed, form-feed, and on- and off-line features, you use them to select standard or NLQ print modes and to set the left and right margins. You can also choose features through software codes.

The 70-page manual for the SP-1000 is

tension for single-sheet paper.

The KX-P1080's printing capabilities, however, overshadow any small problems and surprises you may find. The printer gives you a choice of two fonts (pica and elite), four basic pitches (10, 12, 15, and 17), wide type, and proportional spacing—an unusual variety for a printer in this price range. Although the draft quality type is certainly nothing to write home about, the near-letter-quality type is about as good as you can get from a 9-pin dot matrix printer. The KX-P1080 also produces perfect Epson-type graphics.

Like its more-sophisticated cousins, the KX-P1080 is extremely versatile. It can produce a variety of print sizes and styles, such as 17-pitch NLQ elite wide type. You can also use control codes for special formatting commands such as line centering, justification, and variable line heights.

But you pay a price for all this quality: slower speed and louder sound. The two passes required for NLQ type slows the speed from 73 characters per second to 20 cps. And at 73 decibels, the KX-P1080 is not one of the quietest printers I've ever



DOT MATRIX—\$319–\$379

heard, but it is pitched low enough to be quite tolerable for most situations.

If your software library demands both Epson and IBM compatibility, you may want to forgo the KX-P1080 and spend an additional \$80 for the Panasonic KX-P1091. Also, the KX-P1080's slow NLQ speed may be a bother if you need to print lengthy letter-quality documents on a deadline. But for most purposes, the KX-P1080 is ideal—a steal at its \$319 list price.—*Barbara Krasnoff*

Star NX-10

The NX-10 from Star Micronics just might be the Charlie Brown of 9-pin dot matrix printers—it wavers between a bargain and an albatross. For example, its improvements on the standard Epson design—notably in the paper-feed mechanism and the front panel—make daily use decidedly easier. Those benefits are counterbalanced, however, by its tested default speed of 73.46 characters per second. And its \$349 price tag doesn't really compensate

for the unimpressive print quality. And so it goes. . . .

The clearly labelled, touch-sensitive membrane front panel allows you to select everything from margins through pitch to typeface. But it requires you to exert so much pressure that it raises the question of how long the panel will endure, especially in light of the problems Texas Instruments had with the panel on its early Model 850s. The roller-and-sprocket mechanism permits hassle-free paper feeding and the easy removal of those little strips of paper that gum up the works after the occasional paper jam (something that's chancy at best with the Epson FX series).

While the NX-10 offers standard dot matrix printer features including near-letter-quality and proportional print, they are neither as clean and crisp nor as useful as you would like. The quality of the serif-embellished NLQ face, for example, is only a little better than that of the draft typeface with double-strike. Nor can you combine the NLQ print with the proportional print. The NX-10's double-high print enhancement, while not as good as that on the IBM Proprinter, is acceptable.

While experienced users may find the spiral-bound manual verbose, novices will probably appreciate the folksy tone and the BASIC listings. On the whole, though, the documentation could be better organized, and a quick-reference card or chart would be handy. As it is, the appendices are too busy, and finding what you need is not all that easy. Also, the lack of an index, bad in any manual, is particularly a problem here because most chapters average 20 pages, with no running headings.

You may not want the Star NX-10 in your business environment, but given its low price, you might find it attractive for your home office (as I said—it's the Charlie Brown of printers).—*Vincent Puglia*

Star NL-10

How long could my luck hold out? I thought as I unpacked the Star NL-10. While my colleagues downed aspirin to assuage their printer-induced headaches, I'd been fortunate: so far no losers. The odds were against me, but the stars were favorable. Or at least one star was, for the Star NL-10 didn't let me down.



Star NL-10

Star Micronics America Inc.

3 Oldfield

Irvine, CA 92718

(714) 768-4340

List price: \$319 (plus \$60 for parallel interface, \$90 for serial interface)

Weight: 13.2 lbs.

Dimensions (HWD): 15.7×13.2×4.1 in.

Made in Japan

In Short: Installation and loading paper are easy with the Star NL-10. While print quality is good, an especially nice feature is this printer's ability to print tables and columns.

CIRCLE 606 ON READER SERVICE CARD



Star NX-10

Star Micronics

200 Park Ave., #3510

New York, NY 10166

(800) 367-3119

(212) 986-6770 (in N.Y.)

List Price: \$349

Dimensions (HWD): 4.25×15.75×13.25 in.

Weight: 15 lbs.

Made in Japan

In Short: A 9-pin dot matrix printer with so-so quality but low price.

CIRCLE 603 ON READER SERVICE CARD

My heart sank, though, when I saw that I'd have to install the printer's interface cartridge. Happily, sliding the interface cartridge into the slot at the back of the Star NL-10 and tightening the attached screw was no problem at all. Installing the ribbon cartridge was a snap, too.

The Star NL-10 has a fairly typical look—something like an Epson. Unlike the Epson FX series printers, the Star NL-10 loads paper automatically. You simply line up the paper with the tractor-feed pins and watch the paper glide smoothly into place.

The paper guide works one way for single sheets and another way for fanfold paper, and it attaches pretty solidly, despite a slight amount of play, to the body of the printer. You can't run the printer without the well-designed printer cover, which isn't hinged but nevertheless functions well, with a slot for the paper to come through. So if you can't start printing and you see the power light but not the on-line

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DOT MATRIX—\$379-\$459

light on, make sure you've replaced the cover.

Now I put it to the test, requesting bold-face, draft mode (80, 96, or 136 characters per line), and near-letter-quality mode (80 characters per line) without having to look up and issue a single escape code or formatting command. All I had to do was press the controls on the printer's touch-sensitive panel. You can also request forward or reverse micro-feeding and set the top-of-form and the left and right margins

direct instructions and easy-to-follow illustrations. One small complaint: the version I received had some nearly illegible type samples; they looked as if they had been printed with a worn-out ribbon and then photocopied. The rest of the manual looked good and had a complete table of contents but no index. One particularly handy table shows you how to mix print styles with a single command, adding the values of the features that you want to combine.

I've kept some of the best news for last. The Star NL-10 lists for only \$319, plus \$60 or \$90 for the IBM cartridge interface. With everything else the printer has going for it, the reasonable price makes the Star NL-10 a truly bright star in the current printer market. —Carol Olsen Day

Fortis DM2010 and DM2015

The Fortis DM2010 and DM2015 printers reminded me of D.H. Lawrence's poem on the nondescript use of the word *nice*. The two are perfectly acceptable but basically undistinguished dot matrix printers.

The Fortis DM2015 has an extra-wide carriage, but in all other respects it's identical to the DM2010. Both arrive with a generic manual called the Dot Matrix Printer Operation Manual (literally, no model numbers attached), a fairly explicit document despite the fact that the language seems to be a bad translation of Japanese. Luckily, the clear diagrams in the manual are very helpful, and setup is straightforward. The printers come with two plastic covers, a dust cover and a noise cover that you must remove before setup. A paper separator and an Epson ribbon cartridge slide easily into place.

Two DIP switches for setting the desired print control mode—standard or IBM—are located behind the back panel. The factory settings on both machines were set correctly for standard mode. The DIP switches also give you access to special features such as the 8K-byte input buffer. The adjoining panel consists of the parallel interface card, quickly slipped out and replaced by the optional serial interface card. From this point on it's just a matter of adjusting the tractor-feed mecha-



Fortis DM2010 and DM2015

Dynas Inc.
6070 Rickenbacker Rd.
Commer, CA 90040
(800) 443-9629 (in East)
(800) 241-0947 (in West)
List Price: DM2010, \$459; DM2015, \$599
Dimensions (HWD): DM2010,
4.4×17.3×13.8 in.; DM2015,
4.4×24.9×13.8 in.
Weight: DM2010, 17.6 lbs.;
DM2015, 22 lbs.
Made in Japan
In Short: The Fortis DM2010 and DM2015
are average options in the low-end dot matrix
category.

CIRCLE 100 ON READER SERVICE CARD

by pressing combinations of these controls. When you've set the various print modes this way, they override whatever software commands you've given it.

With the interface I installed, the Star NL-10 became completely IBM compatible. Other cartridge interfaces are available to adapt the printer to different systems. Print quality is good in draft mode, and I really like the sharp, formal-looking near-letter-quality mode. Unfortunately, the Star NL-10 offers no NLQ proportional print, but you can't have everything, I guess.

The printer's ability to handle reverse line-feeds is a nice feature. The Star NL-10 can move the paper up or down so you can move around the page at will. You can press escape codes to advance the paper or reverse it. This feature enables you to print several columns of text side by side or print a graph and then move back up and insert descriptive legends.

Print speed is competitive with other printers of this type: 72 characters per second in draft mode and 18 cps in NLQ mode. And at a tested sound level of 81 decibels, the Star NL-10 won't force you to leave the room when it's printing.

The Star NL-10's manual uses clear,

nism (which, incidentally, I found eating the paper more often than holding it in place) and inserting your choice of fanfold or single-sheet paper, selectable by a lever on the right side.

When I turned on the Fortis DM2010 and DM2015, I discovered one of the annoying things about these printers—the error buzzer. A beep when you make an error is all well and good; but when the buzzer starts beeping and the LEDs in the lower-right-hand corner begin flashing because the dust cover is up, you might begin to wonder whether that buzzer is going to go off every few minutes. Other errors indicated by beeps and/or flashes are more appropriate—unusual voltage, driver error, paper jam, and so on.

While you can operate all formatting and printing commands from the keyboard, a touch-sensitive membrane-switch control panel on top of the machine lets you select one of four type pitches as well as the near-letter-quality mode and line-or



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1414 Massachusetts Ave., Boxborough, MA 01719.

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form-feed. I ran the DM2010 and DM2015 through speed and sound tests. Surprisingly, the DM2015 was slower and louder. Dynax rates both printers at 200 characters per second in default mode; the fastest they were able to wing along on the PC Magazine Labs test was at 115 cps for the DM2010. Furthermore, at 81 decibels (DM2010) and 83 decibels (DM2015), these printers aren't exactly quiet. The sound during the printing of characters wasn't too intrusive, but while printing graphics, the printers sounded like a car about to lose its muffler.

Print quality is about what you would expect from a 9-pin printhead—rough yet reasonably defined. The NLQ mode is not the stuff of which business letters are made, but it is suitable for some interoffice correspondence. As an option, Dynax offers font cards.

Essentially, the Fortis DM2010 and DM2015 are simple to use and moderately fast; they produce satisfactory print quality, but you wouldn't send the output to anyone you wanted to impress. The Fortis DM2010 and DM2015 are acceptable printers for their price range, but they certainly don't outshine the rest of the pack.

—Gretchen Luchsinger

Diconix 150

Everyone laughed when I sat down to review the Diconix 150 ink jet printer. They made jokes about ink jet printers in general and about the tiny size of this one in particular. I was looking forward to working with the 150, and I'm happy to report that both Diconix and I were vindicated. The Diconix 150 is designed to fit a special niche—use by laptop computer owners—and this little printer does that job very well, thank you.


A notebook-size ink jet printer, the Diconix 150 weighs 3.75 pounds with its five rechargeable nickel-cadmium batteries installed. The printer runs on AC power or batteries, which are not included. The 150 is good for 50 minutes of continuous printing or 12 hours of "standby" time when using the batteries.

The 150 accepts either single-sheet or fanfold paper, using a tiny pin-feeding system for the latter. Specially treated coated paper yields the best character resolution


with the 150, but unlike many ink jet printers this one works reasonably well with untreated paper. If you keep in mind the (portable) purpose for which this printer is designed, its output is certainly acceptable. Its print quality does not compare well with laser, daisy wheel, or even most newer dot matrix printers. But, then again, how many of them can you use on a camel's back? Or your puppy's?

Ink jet printers are notorious for leaky ink cartridges, but I'm relieved to say that the 150 kept its ink to itself. A little blotter pad prevents the ink from building up on the paper while the printer is at rest. Getting the ink cartridges to work is a bit tricky. I found I had to push with a paper clip through a tiny hole on the back of the cartridge to get the ink flowing at first. The manual warns explicitly against using an opened paper clip, but an addendum allows judicious paper clip use.

The 150 has some nifty extra features such as script mode and near-letter-quality mode. I found, however, that the 150 had somewhat limited compatibility with the IBM Proprinter and the Epson FX series.



FACT FILE



Diconix 150
 Diconix Inc., a Kodak Co.
 3100 Research Blvd.
 Dayton, OH 45420
 (513) 259-3100
List Price: \$479
Dimensions (HWD): 1.9 × 10.8 × 6.5 in.
Weight: 3.75 lbs.
 Made in Japan
In Short: A tiny, battery-operated, ink jet printer with acceptable speed and print quality for printing on the move with laptop computers.
CIRCLE 66 ON READER SERVICE CARD

In both cases horizontal margins were off on our text-compatibility test, and in Proprinter mode underlining overlapped the bottoms of typed characters. Graphics were fine, though, with passing grades for compatibility with both the IBM Proprinter and 5152 Graphics Printer and the whole Epson FX series. And the 150 did a fine job of printing PC low- and high-order character sets.

The Diconix 150 does not burn up paper, but again, a portable printer like this one needn't be expected to be terrifically fast, just acceptably so. And the 150 is just that.

Somehow the 150 scored 62 on our sound test. I don't know where those decibels came from because it sure sounded quieter to me. It's a lot quieter than the Radio Shack Model 100 keyboard, which is often the telltale sign of laptop use on a plane or train.

If the Diconix 150 cost from \$150 to \$250, I bet most laptop PC owners would buy one. At the current price, however, only those who absolutely need portable printing will buy it, and they should be pleased with it. So if you need a truly portable printer, take a look at the Diconix 150.—Bruce Brown

Okidata Microline 192 Plus and 193 Plus

The Okidata Microline 192 Plus and 193 Plus printers are obviously trying very hard to be the kind of good, standard machines that sit on hundreds of corporate desks. Unfortunately, while the printers are lightweight, easy to use, and have the best manuals I've seen in a long time, they are handicapped by print quality that just doesn't measure up to that produced by similarly priced machines.

The Microline 193 Plus is a wide version of its companion, and the two differ so little that they use the same manual. The machines have the generally sleek appearance typical of small printers, including light covers for the printhead and platen areas. The Microline 192 Plus and 193 Plus, at 10 and 13 pounds respectively, are no trouble to unpack and set up.

Both printers accept paper either from underneath or from behind. Instead of a

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The built-in bi-directional tractor speeds paper handling too. Just flick a switch to go from continuous forms to single-sheet feeding, without removing cumbersome optional tractors or tractor paper.

The well-designed operator panel gives you fast, convenient control of all printer functions, and enables you to identify error conditions quickly.

DX printers won't distract you from your work either — thanks to their quiet operation at less than 55 dBA.

And in addition to fast spread sheets, Fujitsu's DX printers produce near-letter-quality print and excellent graphics. They'll grow with your needs, too. Upgrading to color, or changing your system interface, is as easy as plugging in a new module.

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For more information about the new Fujitsu DX family of printers, call Fujitsu America, Peripheral Products Division, at (800) 626-4686. Get the personal printers that really produce.

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CIRCLE 309 ON READER SERVICE CARD



FUJITSU AMERICA





standard tractor-feed mechanism, the Microline 192 Plus comes equipped with what the manual calls "platen pins": small pins that are set into the platen and hold tractor-feed paper in place. The Microline 193 Plus comes with a separate tractor-feed mechanism that snaps onto either end of the platen (the tractor-feed can also be purchased separately for the 192 Plus). I had no trouble with either the pin- or tractor-feed; however, although the Okidata Corp.'s paper separator managed to keep the incoming and outgoing paper apart, it could not prevent the machine from repeatedly pulling paper back through.

Okidata must be one of the few printer manufacturers still building machines with button switches rather than the touch-sensitive membranes that are everywhere these days. The Microline 192 Plus and 193 Plus printers are equipped with four of these switches on their left front panels, labeled Line Feed, Form Feed, TOF (top-of-form) Set, and Select (or on-line/off-line). There are also alarm and power indicator lights.



FACT FILE



Okidata Microline 192 Plus and 193 Plus
Okidata Corp.

532 Fellowship Rd.
Mt. Laurel, NJ 08054
(800) OKI-DATA
(609) 235-2600

List Price: Microline 192 Plus, \$499;
Microline 193 Plus, \$749

Dimensions (HWD): Microline 192 Plus,
5×15×14.9 in.; Microline 193 Plus,
5×21×14.9 in.

Weight: Microline 192 Plus, 9.9 lbs.;
Microline 193 Plus, 13 lbs.
Made in Japan

In Short: Medium-priced, efficient printers
that would be better bargains if they offered
higher print quality.

OFFICE 800 ON READER SERVICE CARD

Okidata includes a character-set program called *Okifont*, which allows you to pick from several different fonts or create your own.

Programming the Microline 192 Plus and 193 Plus is relatively simple. You put the machine into programming mode by pressing the form-feed and on-off switches simultaneously. Once the machine indicates it is ready, you can press the select button to print out a listing of all the programmable features, including print mode (draft, utility—the default mode—and near-letter-quality), characters and lines per inch, several print enhancements such as emphasized and double-width print, language set (the printer comes equipped for several), and printer functions such as auto-line-feed and carriage return. You choose the "function you wish to change by pressing the line-feed and form-feed buttons, which scroll back and forth through the various functions.

The printers include a fair number of print enhancements, including underlining, compressed and wide type, variable line heights, and other important features. Okidata also includes a simple but efficient character-set program called *Okifont*, which allows you to pick from several different fonts or create your own. Unfortunately, this convenience is overshadowed by the print quality, which does not meet the standards set by many of these printers' competitors.

I had no problems with what Okidata calls the "utility" mode, which furnishes quite readable draft-quality type and does not add appreciably to the room's noise level. The printer also has a draft mode that has considerably fewer dots per character and is supposed to be much faster, but in the PC Magazine Labs tests the draft mode

came out only 10 characters per second faster than the utility mode, making it somewhat superfluous.

The NLQ mode will disappoint anyone who has been exposed to the fine type quality offered by some of these printers' peers. Although the characters are dark and generally unbroken, they are not nearly as smooth as those of other dot matrix printers in the same league. In addition, Okidata has, for some reason, chosen to use a squared-off font that constantly reminds you that you've composed the letter on a computer—an effect that most businesses want to avoid.

The Okidata Microline 192 Plus and 193 Plus printers are efficient, easily programmable small printers. But none of their attributes counts for much unless Okidata can supply good print quality as well. —*Barbara Krasnow*

Brother M-1509

The M-1509 is a 9-pin dot matrix printer manufactured by Brother, a company that gained its fame in the daisy wheel business. The printer incorporates a handsome design and a respectable array of features at an affordable price. For a wide-carriage printer (136 columns), the Brother M-1509 has unusually compact dimensions.

The paper-feed mechanism on the M-1509 is one of the more intriguing designs (à la Rube Goldberg) I've ever seen. It works, it's versatile, but it may be a bit of overkill. Continuous-form printing requires installing a pin wheel unit that looks like a target for a carnival shoot-up game. Unfortunately, the mechanism adds another 2 inches of depth when installed on the rear of the printer. A selectable Sheet front-panel button and two attachable sheet guides help position the single-sheet paper feed. An optional cut-sheet-feeder is available for a reasonable \$149.

While the printer is sophisticated in the mechanics of paper handling, it is primitive in the software to manage the affair. The front switch panel has a membrane keypad Load button to select paper load mode and to allow users to choose between cut sheet-feeder, forms, or single-sheet options. The printer cannot sense which mode you opt for until you select it manually, and, worse still, it cannot remember

Frankly, Nissho is not as well known in the U.S. as Toshiba, NEC or Fujitsu.

So we knew we needed to build a much better printer than the competition to get your attention. And build our reputation.

The Nissho NP-2410 is that printer. And much better it is. Its 24-wire print head produces such beautifully crisp, strikingly black type that some users consider it a letter quality printer.

Where the NP-2410 really shines, however, is printing forms, reports and spreadsheets. Power printing, we call it. The kind of printing you do most.

The NP-2410 flies along at 540 characters per second at 18 characters per inch in draft mode. That gives you a 237-character wide spreadsheet so fast it blows the competition away.

We're faster than the rest at 15 cpi, too. And 12 cpi. And 10 cpi.



And if you think those numbers just make us look good on paper, take a look at how we look printed on paper. The remarkable quality and clarity of the NP-2410's output has to be seen to be believed. The spreadsheet below is an unretouched example. **And this is how good we look in Century Proportional.**

It's just one of seven built-in fonts, all thumbwheel selectable. As are bold/italic selection, and form length.

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At 540 cps, Nissho's draft blows the competition away.

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	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1981	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
1982	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
1983	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
1984	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
1985	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
1986	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
1987	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000
1988	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
1989	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000
1990	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
1991	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000
1992	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000
1993	13,000	13,000	13,000	13,000	13,000	13,000	13,000	13,000	13,000	13,000	13,000	13,000
1994	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000
1995	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
1996	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000
1997	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000
1998	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000
1999	19,000	19,000	19,000	19,000	19,000	19,000	19,000	19,000	19,000	19,000	19,000	19,000
2000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
2001	21,000	21,000	21,000	21,000	21,000	21,000	21,000	21,000	21,000	21,000	21,000	21,000
2002	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000
2003	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000
2004	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000
2005	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
2006	26,000	26,000	26,000	26,000	26,000	26,000	26,000	26,000	26,000	26,000	26,000	26,000
2007	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000
2008	28,000	28,000	28,000	28,000	28,000	28,000	28,000	28,000	28,000	28,000	28,000	28,000
2009	29,000	29,000	29,000	29,000	29,000	29,000	29,000	29,000	29,000	29,000	29,000	29,000
2010	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
2011	31,000	31,000	31,000	31,000	31,000	31,000	31,000	31,000	31,000	31,000	31,000	31,000
2012	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000
2013	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000
2014	34,000	34,000	34,000	34,000	34,000	34,000	34,000	34,000	34,000	34,000	34,000	34,000
2015	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000
2016	36,000	36,000	36,000	36,000	36,000	36,000	36,000	36,000	36,000	36,000	36,000	36,000
2017	37,000	37,000	37,000	37,000	37,000	37,000	37,000	37,000	37,000	37,000	37,000	37,000
2018	38,000	38,000	38,000	38,000	38,000	38,000	38,000	38,000	38,000	38,000	38,000	38,000
2019	39,000	39,000	39,000	39,000	39,000	39,000	39,000	39,000	39,000	39,000	39,000	39,000
2020	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
2021	41,000	41,000	41,000	41,000	41,000	41,000	41,000	41,000	41,000	41,000	41,000	41,000
2022	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000	42,000
2023	43,000	43,000	43,000	43,000	43,000	43,000	43,000	43,000	43,000	43,000	43,000	43,000
2024	44,000	44,000	44,000	44,000	44,000	44,000	44,000	44,000	44,000	44,000	44,000	44,000
2025	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000
2026	46,000	46,000	46,000	46,000	46,000	46,000	46,000	46,000	46,000	46,000	46,000	46,000
2027	47,000	47,000	47,000	47,000	47,000	47,000	47,000	47,000	47,000	47,000	47,000	47,000
2028	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000
2029	49,000	49,000	49,000	49,000	49,000	49,000	49,000	49,000	49,000	49,000	49,000	49,000
2030	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
2031	51,000	51,000	51,000	51,000	51,000	51,000	51,000	51,000	51,000	51,000	51,000	51,000
2032	52,000	52,000	52,000	52,000	52,000	52,000	52,000	52,000	52,000	52,000	52,000	52,000
2033	53,000	53,000	53,000	53,000	53,000	53,000	53,000	53,000	53,000	53,000	53,000	53,000
2034	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000
2035	55,000	55,000	55,000	55,000	55,000	55,000	55,000	55,000	55,000	55,000	55,000	55,000
2036	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000	56,000
2037	57,000	57,000	57,000	57,000	57,000	57,000	57,000	57,000	57,000	57,000	57,000	57,000
2038	58,000	58,000	58,000	58,000	58,000	58,000	58,000	58,000	58,000	58,000	58,000	58,000
2039	59,000	59,000	59,000	59,000	59,000	59,000	59,000	59,000	59,000	59,000	59,000	59,000
2040	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
2041	61,000	61,000	61,000	61,000	61,000	61,000	61,000	61,000	61,000	61,000	61,000	61,000
2042	62,000	62,000	62,000	62,000	62,000	62,000	62,000	62,000	62,000	62,000	62,000	62,000
2043	63,000	63,000	63,000	63,000	63,000	63,000	63,000	63,000	63,000	63,000	63,000	63,000
2044	64,000	64,000	64,000	64,000	64,000	64,000	64,000	64,000	64,000	64,000	64,000	64,000
2045	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000
2046	66,000	66,000	66,000	66,000	66,000	66,000	66,000	66,000	66,000	66,000	66,000	66,000
2047	67,000	67,000	67,000	67,000	67,000	67,000	67,000	67,000	67,000	67,000	67,000	67,000
2048	68,000	68,000	68,000	68,000	68,000	68,000	68,000	68,000	68,000	68,000	68,000	68,000
2049	69,000	69,000	69,000	69,000	69,000	69,000	69,000	69,000	69,000	69,000	69,000	69,000
2050	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
2051	71,000	71,000	71,000	71,000	71,000	71,000	71,000	71,000	71,000	71,000	71,000	71,000
2052	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000
2053	73,000	73,000	73,000	73,000	73,000	73,000	73,000	73,000	73,000	73,000	73,000	73,000
2054	74,000	74,000	74,000	74,000	74,000	74,000	74,000	74,000	74,000	74,000	74,000	74,000
2055	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000
2056	76,000	76,000	76,000	76,000	76,000	76,000	76,000	76,000	76,000	76,000	76,000	76,000
2057	77,000	77,000	77,000	77,000	77,000	77,000	77,000	77,000	77,000	77,000	77,000	77,000
2058	78,000	78,000	78,000	78,000	78,000	78,000	78,000	78,000	78,000	78,000	78,000	78,000
2059	79,000	79,000	79,000	79,000	79,000	79,000	79,000	79,000	79,000	79,000	79,000	79,000
2060	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000
2061	81,000	81,000	81,000	81,000	81,000	81,000	81,000	81,000	81,000	81,000	81,000	81,000
2062	82,000	82,000	82,000	82,000	82,000	82,000	82,000	82,000	82,000	82,000	82,000	82,000
2063	83,000	83,000	83,000	83,000	83,000	83,000	83,000	83,000	83,000	83,000	83,000	83,000
2064	84,000	84,000	84,000	84,000	84,000	84,000	84,000	84,000	84,000	84,000	84,000	84,000
2065	85,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000
2066	86,000	86,000	86,000	86,000	86,000	8						



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DOT MATRIX—\$549



Brother M-1509

Brother International Corp.

8 Corporate Pl.

Piscataway, NJ 08854

(800) 526-3537;

(201) 981-0300 (in N.J.)

List Price: \$549

Dimensions (HWD): 3×19.3×12 in.

Weight: 14.7 lbs.

Made in Japan

In Short: A 9-pin dot matrix printer that is both Epson- and IBM-compatible; while it's not a speed demon, the print quality is good.

CIRCLE 666 ON READER SERVICE CARD

which option you choose in any sort of nonvolatile memory. So, for example, it can't sense that you're using the pin wheel mechanism and continuous forms. You've got to be near the printer so you can manually select that mode each time you power up or reenter from off-line.

I found the membrane keypad too sensitive to the touch and too much in the forefront. Because it isn't recessed from the printer body, I accidentally went off-line during my printing. If you, like me, are in the terrible habit of using your printer as a storage table, you'll be in trouble with the M-1509.

The M-1509 houses both parallel and serial interfaces, which allow for unobstructed paper feed since they are located on the side (not rear) of the printer. Three banks of hard-to-read, hard-to-get-at DIP switches are located on the printer's circuit board beneath a removable cover.

The printer supports both the Epson FX series and IBM 5152 Graphics Printer compatible control sequences. Unfortunately, the documentation continually refers to Epson and IBM as "Mode I" and "Mode II." I spent inordinate amounts of time looking for the solitary reference that told me which mode corresponded to

which standard. Two optional font boards are available. The LQ-100 contains three fonts (\$74.95), and the LQ-200 contains three fonts and a 16K-byte buffer (\$99.95).

Part of Brother's master plan for a comprehensive printer series that will ultimately include a narrow-carriage version and a faster version, the M-1509 does not win any prizes for speed. It is, however, exceptionally quiet, and both near-letter-quality and double-strike emphasized print are good. The draft mode is not especially good, though, and the diagonals on characters like *k* and *x* seem to be exceptionally weak. And if you're in a hurry for hard copy, the M-1509 might leave you hollering "Oh, Brother!"—**Robin Rankin**

Mannesmann Tally 85

The stocky, sturdy Mannesmann Tally 85 is an adaptable, willing hard worker, just the kind of machine you want on your team. It responds quickly to familiar commands, and it even has a good sense of humor, clearly demonstrated by its friendly manual. Not only that, its print quality, speed, and sound level are very respectable for a worker who commands \$549.

After an initial "orientation," the MT 85 is an ideal assistant. It's compatible with other workers in the office—both Epson FXs and IBMs. It uses a high-density dot matrix to form near-letter-quality letters that you won't be afraid to use for important correspondence. The MT 85 gives you clear draft quality (though clearly dot matrix—you can count the dots) in good time: 88 characters per second. Whatever you ask it for, the MT 85 will deliver—underlined, double-strike, enhanced, proportional, and proportional NLQ. And it recognizes standard formatting commands so you won't have to learn a new language to tell it what to do.

In addition to the built-in standard and italic typefaces, you can use font cartridges that plug into the front of the MT 85 and give it the ability to print in Courier, Letter Gothic, or Italic II.

At first the MT 85 seems ready to dive into the job right out of the box. But like any new worker, the MT 85 needs a brief period of adjustment before it gets up to speed. Everything seems to be in the right

place: on/off switch on the lower right in the back; push-button controls on the right front where they're handy to get at; and rugged lift-up cover with window, forming the top of the printer (too bad it's not hinged, though).

But then you learn that before you can do anything, you have to install the interface board yourself. The reason is that the manufacturer makes several interface boards so that the MT 85 will work with personal computers having different operating systems. It sends along the right board, but for some reason doesn't put it in. Luckily, if you use the proper-size screwdriver, the process is as easy as the manual says it is: you unscrew two small screws that hold the panel over the interface slot on the back of the printer, then gently slide it into the slots in the printer housing, and then refasten the panel. Nonetheless, a few precautions are necessary. You have to be sure to "ground" yourself first by touching something metal so that you won't jolt the sensitive chips on the interface board with a charge of static electricity. You also must take care not to bend the interface board when you take it



Mannesmann Tally 85

Mannesmann Tally Corp.

8301 S. 180th St.

Kent, WA 98032

(206) 251-5524

List Price: \$549

Dimensions (HWD): 6.7×17.1×12.2 in.

Weight: 17.6 lbs.

Made in Japan

In Short: After a slightly rocky installation procedure, you'll find the MT 85 to be a versatile, high-quality printer.

CIRCLE 667 ON READER SERVICE CARD

Our Most Important Product Is



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out of the package, for doing so could break the delicate "traces" that carry electric current among the board's components. If all these warnings make you nervous, relax; a little care is all that's needed.

A little more care will be necessary when you're installing the ribbon cartridge. As the manual says, changing ribbons is a snap—just snap one out and snap another in. But be sure you hear or feel the "snap" before you start to print or the ribbon may have trouble advancing.

The manual does say to turn the tension knob a few times to draw several inches of ribbon through the printhead assembly before you begin. I advise turning it until you are sure that the ribbon has been engaged. Once you learn how to load the ribbon properly, you won't have to learn again.

After a short period of adjustment, everything went smoothly—installing both the tractor-feed unit and the paper separator rack was a cinch, as was loading the paper. Something I really appreciate is not having to set DIP switches buried deep inside the printer. With the MT 85 you don't have to pry off covers and poke around for tiny pins in the printer's dark insides; instead, the printer asks you a series of questions about which settings you want it to remember (until you reprogram it). You respond, using the on-line alternate form-feed and line-feed switches to indicate whether you want to change the default settings and, if so, whether you want the switch to be on or off—a much easier method.

The mighty Mannesmann Tally 85 may not be your most attention-getting worker, but it will get the job done. In the long run it may prove to be your most loyal assistant—and it won't even ask for a raise.

—Carol Olsen Day

Facit 4513

One of the winning features of the Facit 4513, a high-quality, dual-identity dot matrix printer with switch settings on the back to enable IBM-, Epson MX-, or Epson FX-compatible modes, is that nothing about it is surprising—except maybe its excellent print quality. I had no problems setting up the printer and putting it through its paces. And the print quality, especially in near-letter-quality mode, shows how far

**The 4513's
print quality shows
how far \$600 dot matrix
printers have come in
the past few years.**

\$600 dot matrix printers have come in the past few years.

The Facit 4513, which also has a front-mounted switch to select near-letter-quality print and emulates the graphics modes (in both low and high resolution) as well as the text modes of IBM and Epson printers, comes equipped for both serial and parallel interfaces. Choosing between serial and parallel modes requires only plugging in the appropriate cables. The paper guide,



Facit 4513

Facit Inc.
9 Executive Park Dr.
Merrimack, NH 03054
(603) 424-8000
List Price: \$595

Dimensions (HWD): 5.5 x 17.5 x 13.5 in.
Weight: 19.8 lbs.
Made in Japan

In Short: A solid, easy-to-use dot matrix printer with good graphics and excellent near-letter-quality print.

Circle 695 on Reader Service Card

ribbon, and paper all install easily, and Facit thoughtfully includes one plastic glove to use when installing the ribbon cartridge (two would be even better—my ungloved hand also picked up some ink smudges).

To complete the printer setup, you must set the three sets of external DIP switches, located at the back of the printer. The operator's manual lists three standard switch configurations, for various country's character sets. I chose the configuration called "IBM mode, National set US," but when I ran the Facit 4513, I discovered that the page length switch was set for 8½ inches. But finding the DIP switch setting reference chart in back of the well-illustrated and clearly written manual to make the correction to 11-inch paper length was easy.

The 4513's print quality is the only surprising thing about it, and in this case, the surprise is a very pleasant one. The printer's draft mode is fine, and its NLQ mode is terrific, producing very clean type. In compatibility testing the Facit prints text just like that of an Epson printer, and graphics passes the compatibility tests for the IBM 5152 Graphics Printer and the Epson gang. When printing the high-order character set, however, the 4513 doesn't print double lines for the characters that call for them. ACSII 181 to 190 and 198 to 216. It's not 100 percent IBM compatible but very close.

At 91 characters per second in draft mode, the Facit 4513 is not speedy. The speed drops to 25 cps in near-letter-quality mode—unacceptable for doing large runs of mailing labels or long documents but certainly satisfactory for normal office report and letter printing. And at 79 decibels, the Facit 4513 doesn't really sound too loud, except when it's printing boldface: the screeching noise, like that of many other dot matrix printers, is quite irritating.

Programming the 4513 to invoke printing features is as straightforward as such programming gets. If your word processor controls features such as underlining or superscript printing, you won't need to do any programming yourself. If, however, you do need to program the 4513 to invoke a special feature, be assured that it works just as the manual says it will. Again, the good news is no unpleasant surprises.

The Facit 4513 behaves as ruggedly as it looks and feels. Since it's a well-built,

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IBM: Same

DD: Positive-tactile, firm-feel keys.
IBM: Same.

DD: 12 Function keys for increased automatic operation.
IBM: Same.

DD: Extra-wide, easy-to-find Return key.
IBM: Changed sizes again by shrinking their Return key.

DD: Dedicated Function Control keys.
IBM: Same.

DD: Caps, Num and Scroll Lock indicator lights.
IBM: No lights on their XT.

DD: Isolated Escape key.
IBM: Same.

DD: Enlarged Backspace and Shift keys.
IBM: Same

DD: Separate dedicated Numeric Pad with enlarged Enter key, four Arithmetic Function keys.
IBM: Same.

DD: Switch-selectable compatibility with IBM, PC, XT, AT, PCjr, AT&T and all compatibles.
IBM: Enhanced keyboard runs only on their new XT's, AT's and ignores their installed base which probably includes you.

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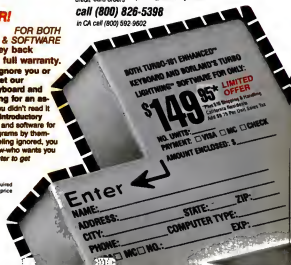
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highly compatible matrix printer with good graphics, very fine near-letter-quality mode, and reasonable speed and noise levels, you'll want to consider the Facit 4513 if you're looking for an all-purpose office printer that will hold up under the stress of heavy use. —Bruce Brown

Olivetti DM280

The Olivetti DM280 has a great manual and a convenient, well-thought-out method of system configuration but is an otherwise fairly standard dot matrix printer. The fact that its best features favor the user creates a welcome bias.

The DM280 is a 9-pin dot matrix printer with moderate speed and type quality. It prints in both draft and letter quality modes and is able to print the PC high-order graphics character set flawlessly. The DM280 is text compatible with both the Epson MX-80 and the IBM Proprinter, and graphics compatible with the IBM 5152 Graphics Printer, the IBM Proprinter, and the Epson MX-80.

The best feature of the Olivetti DM280 is its ability to change its power-on configuration easily and conveniently. Holding down the line-feed and form-feed keys when turning on the printer's power puts it in configuration mode, causing it to ask a series of questions printed on paper. All questions require you to give a "yes" or "no" answer, or, as Olivetti terms it, to Confirm or Change.

To agree with the option and the response printed, such as "Near-letter-quality mode: No," hit the line-feed button. To change from the current default, tap the form-feed button. Your responses are printed also. If you want to change an option that has several possible settings, the program branches to allow you to achieve the desired setting. If you save the parameters, they become new defaults. The Olivetti DM280 is not the only printer that can change power-on defaults through printer firmware, but such convenience in a low-cost printer is laudable.

Preparing the printer for use is otherwise pretty standard: take out plastic and foam, put in ribbon cartridge, insert paper, attach power cord and printer cable. The Olivetti DM280 has one feature I find aggravating, though: the substitution of a

The DM280's manual is quite inclusive, and it highlights the most important information in red.

"local" button and indicator light on the printer for the more familiar "on-line/off-line" button. This configuration, which appears on other Olivetti printers as well, causes no confusion once you're used to it, but it does buck the standard.

The Olivetti's manual is the other user-considerate feature that deserves favorable mention. It's quite inclusive, and it highlights the most important information in red. The illustrations are clear and helpful.

Although the Olivetti DM280 is a reasonably well performing dot matrix print-

er, it's in the most competitive category of printers, which includes the IBM Proprinter as well as the Epson, Okidata, and Panasonic printers. So, even with the printer's easily resettable power-on defaults and its good manual, it would be hard to recommend it over some of the other, more proven machines in its category. —Bruce Brown

Fujitsu DX2200

If the Fujitsu DX2200 printed only in black and white, it might not be that attractive a value. After all, it's a mid-, not low-priced dot matrix printer with only a 9-wire printhead. The DX2200 also gives you color printing capabilities, however, and in the color printer market, this printer competes quite well.

Equipped with a color option, which adds \$150 to the base model list price of \$649, the DX2200 uses a typical four-color or fabric ribbon cartridge and can print in seven different colors. It produces the three extra colors by printing a second pass with a different color. Through careful programming and use of the available escape-code commands, you can also produce other color combinations. The colors are clean, and the blended hues are fairly even.

Fujitsu deserves extra credit for the printer's compatibility. The DX2200 tested as fully compatible with the IBM 5152 Graphics Printer commands, making it easy to configure for use with most programs. Not content to leave it at that, the Fujitsu designers added IBM Proprinter compatibility, and so changing from one emulation to the other is as easy as changing a DIP switch at the back of the printer.

Printer setup and switch settings are straightforward and painless. The machine has a standard self-test trigger. And in addition to the standard "barber pole" print-out, the printer also reports on its switch settings. This makes it a snap to find out the current settings and gives you a printed record to use to check against the manual's tables as you try to figure out which settings need to be changed.

The DX2200 has some other interesting features, such as its top-panel controls. A switch allows you to select near-letter-quality print, and you do not have to take


FACT FILE



Olivetti DM280
 Olivetti USA
 765 U.S. Hwy., #202
 Somerville, NJ 08876
 (201) 526-8200
 List Price: \$595
 Dimensions (HWD): 3.9x16.0x11.6 in.
 Weight: 14.5 lbs.
 Made in Italy
 In Short: A dot matrix printer that performs moderately well, with some very user-considerate features.

CIRCLE 60 ON READER SERVICE CARD



DOT MATRIX—\$645



FACT FILE



Fujitsu DX2200

Fujitsu America
3055 Orchard Dr
San Jose, CA 95134
(800) 626-4686
(408) 946-8777

List Price: \$645; monochrome; \$795, color
Dimensions (HWD): 4.7 x 22.8 x 19.6 in.
Weight: 24 lbs.

Made in Japan

In Short: A moderate-quality dot matrix printer that stands out as a value because it can print color; its black-and-white print quality is only fair.

CIRCLE 669 ON READER SERVICE CARD

The manual is sparse yet thorough. Clear illustrations show you how to set up the printer. More tutorial information on the escape commands and how to use them would be a big help, though.

The DX2200 is solidly built, with a rugged case and well-designed accessories. If you need color and some of the other extras that set the DX2200 apart from the bulk of the mid-priced dot matrix sector of the printer market, the DX2200 is worth a look. If you don't, the print quality and price/performance value alone will not be enough to interest you. —**Alfred Poor**

Juki 5510

When a dot matrix printer includes a four-color ribbon, your hopes soar. But dot matrix printing of color graphs and charts is almost always disappointing, and the Juki 5510's is no exception. Even the color prints in the Juki 5510's manual show some white lines and blemishes. You'll also see some smearing in actual use and will probably have to resort to using Wite-out and color markers to touch up the results.

Aside from the color, the Juki 5510 is easy to use, and its print quality (particularly in the near-letter-quality mode) is generally pretty good. The printer is marred, though, by some quirks, speed problems, and confusion in the manual.

According to the manual, the Juki Series 5500 comprises two models: the 5510 with a black ribbon and the 5520 with a color ribbon. According to Juki Office Machine Corp., though, the 5500 series and the 5520 don't exist. Instead, the Juki 5510 is available with and without color. The color version I tested costs \$648; without color it's \$499. A color upgrade kit is available for \$149, but upgrading the printer to color is probably not something you'd want to do yourself.

DIP switches, accessible from the top under a one-screw cover, let you switch the Juki 5510 among three different compatibility modes: IBM 5152 Graphics Printer, IBM Color Printer, and a "5500 mode," which is actually Epson FX-series compatible. You can get color printing in either IBM Color or 5500 modes with two different sets of control sequences. Although the 5500 mode is supposed to print



FACT FILE



Juki 5510

Juki Office Machine Corp.
23844 Hawthorne Blvd., #101
Torrance, CA 90505
(800) 521-9846

List Price: \$648

Dimensions (HWD): 4.9 x 17.6 x 14.3 in.
Weight: 19.8 lbs.

Made in Japan

In Short: An easy-to-use dot matrix color printer with good near-letter-quality print but, like others in its class, unsatisfactory color printing.

CIRCLE 687 ON READER SERVICE CARD

the printer off-line to make the change. You can feed the paper forward or backward or even have the printer feed the paper backward until it is out of the printer entirely. You can print data from the computer in hex form (instead of ASCII). And you can select many of the different print features, such as pitch and color, by pressing combinations of the front-panel buttons.

Aside from its ability to print in color, however, the printer's performance is unremarkable. The draft print is legible, and the NLQ font is attractive but not as crisp as that of some of the competition. Plus, the DX2200 is no speed demon: Fujitsu claims 220 characters per second, but the PC Magazine Labs test found the speed to be less than 105 cps. The half-speed "quiet" mode slowed draft mode down to 65 cps; yet it dropped the noise level from 74 to 71 decibels. As with most printers in its class, the DX2200 slowed to a crawl in NLQ mode. The printer gives the impression of being slightly quieter than most dot matrix printers, and the half-speed mode was noticeably quieter than the normal mode.

italics for the high-order characters, only one of the two 5510 printers we received did so. The other (a later revision) did not.

One quirk occurs in IBM Color Printer compatibility mode: the Juki 5510 does a funny little dance when printing the line and box high-order characters that require two passes. First it prints part of the character, then it wiggles the paper back and forth a few times, and then it prints the rest of the character. Aside from being amusing, this constant wiggling really slows down printing. In IBM 5152 Graphics Printer compatibility mode, however, the Juki 5510 prints high-order characters without the dance and gets the job done noticeably faster.

The 180-character-per-second speed cited in the manual is exaggerated. The default print quality mode manages a respectable 82 cps, but the NLQ mode slows down to 15 cps. The mechanism that shifts the ribbon up and down for color printing is also quite slow.

Much of the nearly 200-page-long manual concerns connecting the Juki 5510 to different computers. In the section on



the PC, you get step-by-step instructions on installing the Juki 5510 for some popular applications programs. The manual's tables and explanations of control sequences mix all three compatibility modes together and identify them by abbreviations; the result is confusing. Also, the manual includes some BASIC examples with key words run together without spaces; they won't work if you type them in as shown.

If you need color, you'd be better off with a plotter. Dot matrix and ink jet printers simply are not satisfactory. If you accept that fact, the Juki 5510 is adequate but hardly exemplary. —Charles Petzold

C. Itoh C-310 XP and C-315 XP

C. Itoh has put new life into its aging C-310 EP printer by adding IBM Proprinter compatibility and friendlier, front-panel controls. The result is its C-310 XP and C-315 XP printers—both worth a good close look.

The C-310 XP and the C-315 XP (the wide-bodied version) are essentially the same printer; they even come with the same extremely well-written and easy-to-follow manual. Both are nicely streamlined in appearance and use three interlocking covers: a back paper cover that also props up for single-sheet printing, a front dustcover, and a third, removable platen cover that helps cut down on noise. Four touch-sensitive membrane switches, along with power and alarm indicator lights, run along the right side of the front panel; the on/off switch is within easy reach on the right side of the machine, while a socket for optional font cartridges is on the left. The C-310 comes with a simple, single-wire paper guide, while its wider cousin has a slightly more efficient assembly. The printers' tractors can push or pull form-feed paper from the back (although the manual encourages using the tractors as a push mechanism for higher-quality print), or they can pull the forms from a bottom slot. The tractors will also accept single sheets.

The C-310 and C-315 are part of an expanding parade of printers that have abandoned their DIP switches in favor of as-



C. Itoh C-310 XP and C-315 XP

C. Itoh Digital Products Inc.
19750 S. Vermont Ave., #220
Torrance, CA 90502
(800) 348-1984
(213) 327-2110

List Price: C-310, \$649; C-315, \$819
Dimensions (HWD): C-310, 5×7×13.5 in.; C-315, 5.5×22×13.5 in.
Weight: C-310, 20 lbs.; C-315, 28 lbs.
Made in Japan

In Short: Two new C. Itoh printers that offer a nice variety of print options and a unique programming system that is a considerable improvement over the clumsy DIP switch arrangement.

CIRCLE 861 ON READER SERVICE CARD

signing multiple duty to the on-line, paper-feed, and other switches. In this case, the letter quality/near-letter-quality toggle also acts as a "function key," which, when pressed simultaneously with the printers' on/off switch, puts the machines into programming mode. The C-310 and C-315 immediately print out a list of the current defaults for IBM/Epson emulation, form length, lines and characters per inch, buzzer operation, and the LQ/NLQ toggle. (In either mode, the printers will also produce draft quality type.)

By using the line-feed and top-of-form switches as, respectively, up and down cursors, you can choose which of these functions to change. Each function has a numbered place in the list; for example, if you wanted to change lines per inch, you would first press the "down" switch twice, taking it to function 02: LPI. Meanwhile, the combination on-line/menu key gives access to options for each category: 11, 12, or 14 lines per inch. When that switch is active, the cursors will take you

to each option in turn. If you then return to print mode, that option becomes the new default.

These printers produce highly legible types in both NLQ and LQ modes. In fact, to my eyes the only difference was that the NLQ was in a plain pica font, while the LQ was in a slightly more elaborate Courier. There's only a slight gap in their speeds as well: at 38 characters per second for NLQ and 30 cps for LQ, you really can't avoid a wait with either one. (In PC Magazine Labs speed tests, the C-310 sped up to 157 cps for draft, while the C-315 rated 150.) The look of both typefaces is excellent but not perfect; rounded letters like *p* and *s* look a bit ragged.

The C-310/C-315 XP printers are good-quality, reasonably priced machines offering flexibility of function. Businesses with a variety of format needs and a libraryful of IBM- and Epson-compatible software could find C. Itoh's latest printers fit right in with their plans. —Barbara Krasnoff

Okidata Microline 290 Series

Okidata has been in the printer business long enough to know what makes a good printer, and the Okidata Microline 290 series proves it can deliver the goods. The Microline 290 series contains four printers that herald Okidata's new generation of 18-pin printers and affirm its commitment to color printing. All the Microline 290 printers have near-letter-quality and draft modes as well as a new high-speed draft mode that increases speed 15 percent over default mode. In addition, the Microline 290 series corrects some past Okidata design inadequacies.

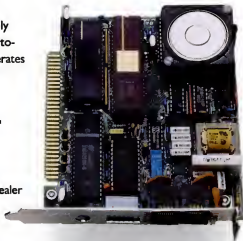
The Microline 290 family relies on a plug-in cartridge that Okidata calls a "personality module." Snapping one of the two available modules into the printer body makes the printer behave as either an IBM- or a "standard" Microline-compatible printer. The IBM personality module is fully compatible with the IBM 5152 Graphics Printer. The standard (Microline) module is compatible with the entire line of Okidata Microline printers. You can purchase each personality module separately.

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Besides having two personalities, the Microline 290 series comes in two widths: narrow and wide. The Microline 292 is the narrow-carriage printer and the Microline 293, the wide carriage; both accept either IBM or standard modules. The Microline 292 uses a simple paper separator and paper-guide mechanism, while the Microline 293 features an acoustic cover and tractor-feed; otherwise the printer bodies are identical. Both are equipped to handle rear and bottom paper feeding.

The IBM version of the printer includes some excellent screen-capture and font-generation software. The standard (Microline) version contains no software. While IBM devotees will probably want to purchase the printer with the IBM personality, those who use a number of different computers or those who already have products that use Microline-compatible escape sequences might want the standard version.

The trademark of the original Okidata Microline series was Plug 'n' Play, an interchangeable ROM chip that let the technically motivated swap the personality of their printers. The next generation—the Microline 190 series of printers—came factory-ready with a single personality already hardwired. Now the new Microline 290 series' plug-in cartridges combine the flexibility of Plug 'n' Play with the simplicity of factory-ready equipment—a nice evolution.

Don't misunderstand. According to Okidata representatives, the Microline 290 series is not intended to replace the Microline 190 series. The Microline 190 series is alive and well—and significantly less expensive. Microline 290 printers do more and cost more. To put it gently, the Microline 290s are intended for a less price-sensitive, more performance-oriented user.

The big news is the 18-pin printhead. Nine-pin printheads are fast enough in draft mode, but performance degrades in double-pass near-letter-quality mode. Eighteen pins, or "dual-9 pins," as many like to think of them, do NLQ printing in a single pass. Hence the NLQ speed of the Microline 290s is twice that of its 9-pin ancestors.

According to some print mavens, the NLQ output created with 18 pins is too thin



Okidata Microline 292 and 293 (both standard or IBM compatible)
Okidata Corp.
532 Fellowship Rd.
Mount Laurel, NJ 08054
(800) OKI-DATA
(609) 235-2600

List Price: Microline 292, \$699; Microline 293, \$899. Personality modules (sold separately as standard or IBM versions), \$110; Microline 292 body, \$589; Microline 293 body, \$789

Dimensions (HWD): Microline 292, 14.4 × 10.8 × 3.2 in.; Microline 293, 20.5 × 10.8 × 3.2 in.

Weight: Microline 292, 8.8 lbs.; Microline 293, 13.2 lbs.
Made in Japan

In Short: The Okidata Microline 290 series printers come with either an IBM or standard Microline-compatible personality module and have either narrow- or wide-carriage widths. All variations incorporate an 18-pin design that makes for fast and attractive NLQ printing and perfect graphics—but for a price. The color option produces handsome results.

CIRCLE 68 ON READER SERVICE CARD

because of the reduced size of the pin heads. I find the text printed by the Microline 290s exceptionally clear and easy to read. The attractive Courier-like font for NLQ mode adds to the clarity.

If the 18-pin text doesn't convince you, then look at graphics. Nine-pin graphics are sparse, and 24-pin graphics are fair imitations of 9-pin graphics. Although some people rave about 24-pin printers, the truth is that they produce elliptical-looking graphics that are slightly incompatible with 9-pin graphics. Since 18 pins are a superset of 9 pins, the graphics created are closer to the 9-pin standard.

Both the Microline 292 and 293 print-

ers have compact desktop footprints, but Okidata has not sacrificed sturdiness for compactness. The "flying" access covers and flimsy pin feeds that plagued previous models are gone. With the power switch and interface now located on the sides instead of the rear of the machines, the design has been ergonomically modernized.

The Microline 290 series uses a menu-select function to access a wide variety of printer features. You enter the menu-select mode by pressing the form-feed and line-feed buttons simultaneously. By pressing various control panel buttons, you can change features such as cpi, NLQ, utility, and draft mode, color, and others. You can return the menu-select mode to the factory-set defaults from the control panel; a stick-on label that sits above the control panel helps you remember how to use the menu-select functions. To its credit, the control panel of the Microline 290 series uses real, honest-to-goodness buttons instead of the less-responsive, shorter-lived touch-sensitive membrane keypads.

The fact that the menu is accessible while the printer is powered on is an especially nice touch. The only weak spot in the menu selection process is the amount of paper you'll go through while making a selection. As the printer shows you the status of the menu, it skips a full ten lines between entries. If you want to change the tenth menu item, you've wasted a good deal of paper. Worse still, the printer cover on the Microline 292 is opaque, so you can't see the line being printed. When the menu-select mode prints out a line, you've got to peer into the depths of the printer to read it.

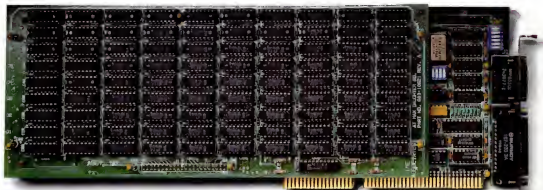
I found the high-speed draft mode only marginally helpful. The speed and quality differences between utility print and NLQ print are substantial, but in the PC Magazine Labs benchmark tests, the high-speed draft mode increased the speed from 119 characters per second to only 132 cps. The high-speed draft mode print quality is only slightly inferior to the utility mode's. The differences between the two are so minimal that, for a short letter, sticking with utility mode is probably faster than taking the time to switch modes.

There are other places for improvement. When you turn the power switch on, the printer's arrival on-line is exasperat-

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CIRCLE 335 ON READER SERVICE CARD



Besides having two personalities, the Microline 290 series comes in two widths: narrow and wide.

ingly slow because its software first searches across the width of the carriage to determine whether the printer is an Microline 292 or 293. Also, the ribbon cartridges are deceptively tidy-looking: because they span the length of the carriage, they are cumbersome and guarantee smudged fingers.

Both the IBM and the standard (Microline) modules support color printing (a four-color ribbon is optional), but only the IBM version comes with the *CSP (Color Screen Print)* software disk. The memory-resident *CSP* software uses 1-2-3-like menus to let you capture graphics screens, then edit the color and design of your work. You can even add your own colors to black-and-white designs. The *CSP* software supports the EGA card, and I achieved some high-caliber results with the EGA and *CSP* combo. However, there is some incompatibility between the Okidata color escape sequences and both the Epson JX-80 and IBM 5182 color printers.

The IBM-compatible version of the Microline 290 series also comes with *Okifont* software. The disk includes four downloadable fonts and lets you create your own character designs.

The two-part documentation for the series is as handsome and functional as the printers themselves. The installation manual includes full-color photos, so there's no room to misinterpret the instructions. The reference volume is concise and well written.

The key to the Microline 290 series is versatility. The two printers offer a complete matrix of wide and narrow, IBM and Microline capabilities. In high-speed

draft, utility, NLQ, or color graphics mode, the printers work intelligently and functionally. And as graphics support for the PC improves, the color option will become increasingly important. If your printing needs are a mixed bag, get yourself an Okidata. It's got winning personalities.

—Robin Raskin

Epson EX-800 and EX-1000

Epson printers have been market leaders for years. Probably more software is written to work with them than with any other brand, and the IBM 5152 Graphics Printer is a slightly modified Epson. Now there's a new Epson, the EX-800, and its wide-carriage version, the EX-1000. Each of them a high-speed, high-print-quality machine with a raft of features, the new EX-800 and EX-1000 are bound to take their place in the Epson winner's circle.



Epson EX-800 and EX-1000

Epson America Inc.
2780 Lomita Blvd.
Torrance, CA 90505
(800) 421-5426
(213) 539-9140 (in Calif.)
List Price: EX-800, \$749; EX-1000, \$995;
color option, \$79.95
Dimensions (HWD): EX-800,
4.7×17.6×14.9 in; EX-1000,
4.7×23.1×15.1 in.
Weight: EX-800, 22 lbs.; EX-1000, 22 lbs.
Made in Japan
In Short: A 9-pin dot matrix printer, and its
wide-carriage version, with a color option,
good speed, impressive print quality, and a
great manual.

CIRCLE 681 ON READER SERVICE CARD

The Epson EX-800 and the EX-1000 are proof that 9-pin printers are alive, well, and producing better-than-ever results. They try their damndest to imitate the big-league 24-pin printers, with surprisingly good results.

The paper-handling facility of the EX-800 and EX-1000 is simple and error free. The printers use Epson's new built-in push tractor-feed system for continuous paper handling. An easy-to-install paper guide and edge tab are included; so is a paper rest to keep form-feed paper from tangling in the cables. Single-sheet loading is automated, and both single- or dual-bin cut-sheet-feeders are available for \$249.95 and \$399.95, respectively.

The EX-800 and EX-1000 are speedy: 119 characters per second in the default mode on the PC Magazine Labs test. The near-letter-quality print is worth waiting for at 44 cps. The noise during printing? You'll hardly notice it. On the other hand, the noise when you first turn the power on is quite startling. The printhead assembly jumps to attention with a series of shakes, rattles, and rolls.

The most striking feature of the printers is the control panel. It houses eight rose-colored buttons that offer control over the most common print functions. Pressing a control button, you can enable three memory-resident type styles: draft, NLQ roman, and NLQ sans serif; three print sizes: pica, elite, or proportional; and condensed or normal-size print. Various combinations of these buttons provide a variety of print styles without fussing with DIP switches or escape sequences. The buttons are clearly labeled with the name of the feature. As you press buttons to activate print features, they light up.

In addition, the Epson EX series uses two banks of eight DIP switches located unobtrusively, but inconveniently, at the bottom rear of the printer. The printers' self-test lists the current DIP switch settings. A DIP switch setting is responsible for selecting either IBM printer emulation or Epson's own ESC/P (Epson Standard Code for Printers) mode. Another switch selects between the Epson italic character set and the IBM graphics character set. The mere fact that you can choose the IBM graphics character set without having to forsake the Epson command se-

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quences is a real breakthrough.

The overall strategy for the EX-800 and the EX-1000 is sensible. The SelectType feature handles fonts and print widths (with the exception of double widths), while the switch settings and command sequences handle the other print enhancements. The Epson Master Select Escape sequences are incorporated into these printers as well, allowing you to specify a number of print features with a single Escape command. The EX-800 and EX-1000 produce some of the best 9-pin print I've seen yet.

The \$79.95 color kit option comes with a four-color printer ribbon and a small stepper motor. You install the motor easily via a pin connection; it allows the ribbon carrier to move up and down, producing the seven colors supported by the printers' software. The color option uses the Epson JX-80 command sequences, supported by most software packages.

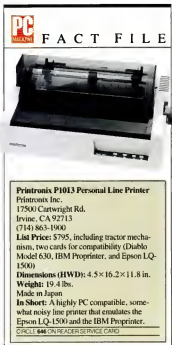
The EX-800 and EX-1000 both come with a 246-page manual, including appendices, index, and glossary. A plastic quick-reference card is bound into the back of the manual. Epson has been selling printers and publishing manuals so long that now it has some of the best documentation in the business.

Yes, the EX-800 and EX-1000 are more expensive than most 9-pin printers. But their menu-selectable print controls, vibrant colors, speedy print time, and impeccable documentation place them a cut above the rest in quality, as well as price.—Robin Rankin and Bruce Brown

Printronic P1013 Personal Line Printer

And now for a new twist on printing... the Printronix P1013 Personal Line Printer brings line printing technology from the mainframe domain to the world of micros.

If you're new to line printing, the technology is kind of neat. Rather than typing one character at a time, a line printer types whole lines once. Thus, the impact dot matrix printhead is much larger than normal; on the Printronix P1013 it's a full 8 inches long. If you stop the Printronix P1013 before it has finished a line, you'll see that the bottom of every character in



Printronix P1013 Personal Line Printer
Printronic Inc.

17500 Cartwright Rd.
Irvine, CA 92713
(714) 863-1900

List Price: \$795, including tractor mechanism, two cards for compatibility (Diablo Model 630, IBM Proprinter, and Epson LQ-1500)

Dimensions (HWD): 4.5 x 16.2 x 11.8 in.

Weight: 19.4 lbs.

Made in Japan

In Short: A highly PC compatible, somewhat noisy line printer that emulates the Epson LQ-1500 and the IBM Proprinter.

CIRCLE 644 ON READER SERVICE CARD

the line is incomplete. As it prints, the whole head moves rapidly from side to side—which is fun to watch. But the fun comes at a high price: the wiggling printhead sounds as obnoxious as a loose Volvo fan belt. Although rated at 57 decibels, it came in on the PC Magazine Labs test at 80 painful decibels loud.

Also unusual is the Printronix P1013's slanted ribbon, with the right side 1/2 inch lower than the left. This inclination is designed to extend the ribbon's life because it allows the printhead to use more of the ribbon's surface.

Apart from its unusual printhead and ribbon placement, the Printronix P1013 Personal Line Printer is fairly conventional. It works well but doesn't provide unusual printing speed or character quality in either draft or letter quality mode. You will find that the Printronix P1013 works well with your PC because it is highly compatible with the higher-order PC character set.

The manufacturer claims that the text is compatible with the IBM Proprinter and

the Epson LQ-1500. While our test for IBM Proprinter compatibility bore out that claim, we had no text-compatibility test for the LQ-1500. However, the Printronix P1013 is graphics compatible with the Epson LQ-1500. In addition, the printer met most of the qualifiers for Epson MX-80 emulation, though boldface failed to work in MX-80 mode. So I feel it's safe to assume that the printer is LQ-1500 text-compatible as well. The product feature sheet mentions that a cartridge is available for Diablo 630 emulation, but that cartridge was unavailable at the time of testing. The Printronix P1013 tested positive on graphics compatibility with the IBM Proprinter and the IBM 5152 Graphics Printer, though graphics in the Epson LQ-1500 mode are cleaner than in the Proprinter mode for some reason.

To switch between the Proprinter and the LQ-1500 emulation modes, you must change the DIP switch settings. Unfortunately, the printer's DIP switches are inconveniently located under the ribbon cartridge; to get to the switches, you must remove the ribbon and push back two cables. This design is unfortunate; you could damage the cables if you switch settings often. More easily accessed is letter quality printing; you simply tap a front-panel switch.

My favorite feature is the Printronix P1013's small tractor paper feed, which works well bidirectionally, a welcome function that is missing from many of the larger tractor units.

Printer installation and setup for the Printronix P1013 was more difficult than it should have been because of the manual, which is poorly organized, incomplete, and printed in poor-quality dot matrix print. One example of the problems caused by the manual is that it doesn't tell you to take out the printhead blocks that prevent head movement during shipping. I was able to figure out what to do, but with only halfhearted help from the manual.

The Printronix P1013 Personal Line Printer produces fine output, but at no great benefit in speed over simple character dot matrix printers. It's interesting to look at but obnoxious to listen to. At \$795 the Printronix P1013 delivers typical quality and speed performance with fine LQ-1500 and IBM Proprinter emulation. May-

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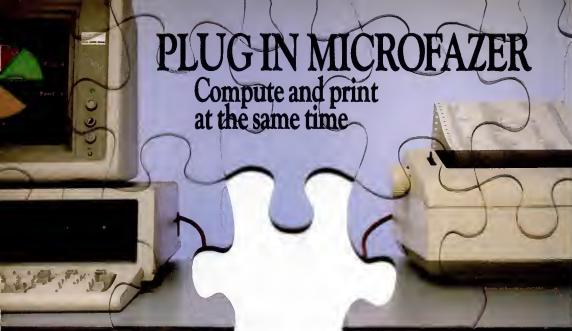
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be future Printronix P1013 Personal Line Printers will be much faster or significantly less expensive than other technologies; until then I'd pass on this one. —**Bruce Brown**

Epson FX-286

Epson, long regarded as the standard in dot matrix printers, now includes a second standard in its new FX-286 model. This printer, which succeeds the FX-185 in Epson's wide-carriage line, can also emulate the now-standard IBM Proprinter.

The FX-286 is also faster than its predecessor, though its still relatively slow but respectable near-letter-quality speed is a result of its 9-pin printhead. The 9-pin printhead also affects print quality. Lower-case descenders, for example, tend to scrunch up. Overall, however, the near-letter-quality mode is surprisingly good in both Epson and IBM Proprinter flavors. Not surprisingly, the FX-286 produces an average amount of dot-matrix-type noise: 77 decibels, generally acceptable in most offices.

The Epson NLQ style differs from that of the IBM mainly in that it uses serif (roman font), while the IBM font doesn't.

PC MAGAZINE FACT FILE



Epson FX-286

Epson America Inc.
2780 Lomita Blvd.
Torrance, CA 90505
(800) 421-5426
(213) 539-9140 (in Calif.)

List Price: \$799
Dimensions (HWD): 6.1x25.5x14.0 in.
Weight: 23 lbs.
Made in Japan

In Short: A wide-carriage, 9-pin dot matrix printer in the Epson tradition of high quality at an affordable price.

CIRCLE 107 ON READER SERVICE CARD

Like its draft mode, Epson NLQ mode can be double width, emphasized, superscripted, subscripted, and underlined. However, near-letter-quality type is not available in elite, proportional, condensed, double strike, or italic. In IBM Proprinter NLQ mode, the printer can produce elite type, but not the others. You can change the default setting to IBM Proprinter mode by changing the settings of the three DIP switches under the plastic cover on the FX-286's top right-hand side.

The FX-286 has the classic Epson design, with a cover that slopes up and over the printer's tractor-feed. Three pushbuttons on the control panel let you choose among many print options. A feature called SelectType gives you a hardware way to select the various print modes, and it also offers one other choice called "skip over perforation." A chart above the panel shows the different options available with SelectType. Also, a special software mode called Master Select lets you choose any combination of seven different print modes with a single escape code.

When default DIP switches are set to IBM Proprinter mode, the FX-286 uses an IBM character set and a slightly different set of control codes. Three different character sets are available in IBM Proprinter mode: standard, alternate, and all print. Each mode can be either draft or NLQ mode. You can select standard or alternate sets by changing a DIP switch, while you must use an escape code to select the all print set. The FX-286 has ten different graphics modes, including single-density, low-speed double, high-speed double, and quadruple.

The wide-carriage FX-286 comes standard with friction- and tractor-feed (the tractor is removable). The sometimes annoying pin-feed mechanism, found on Epson's narrow-carriage printers, is not used on wide-carriage models like the FX-286. An 8K-byte print buffer, which you can upgrade to 40K for \$175, is standard. Also, the FX-286's clear manual is of the usual Epson high quality.

Although somewhat limited by its 9-pin printhead design, the FX-286 comes through with a good NLQ quality print at an acceptable speed. If you need a wide-carriage printer, the FX-286 is a worthy candidate. —**Joe Desposito**

Epson LQ-800 and LQ-1000

Epson America keeps on rolling along, making superior printers. The Epson LQ-800 and Epson LQ-1000 (the wide-carriage version of the LQ-800) are 24-pin printhead dot matrix printers that produce beautiful type. The Epson LQ-800 and LQ-1000 are also fast (105 characters per second) and include several convenient and useful features. Competitively priced, the Epson LQ-800 or LQ-1000 is a good choice if you're looking for a standard dot matrix printer.

The Epson LQ-800 is not a large printer, in fact it seems rather slight. The printer's low line is just right to fit into many of the special computer tables or hutches on the market. Its wide-carriage sibling, the Epson LQ-1000, takes up 8 inches more of your work space, but it's still less than 4 inches high and just over 13 inches deep. Tucking the Epson LQ-1000 into various

PC MAGAZINE EDITOR'S CHOICE FACT FILE



Epson LQ-800 and LQ-1000

Epson America Inc.
2780 Lomita Blvd.
Torrance, CA 90505
(213) 539-9140

List Price: LQ-800, \$799; LQ-1000, \$1,095

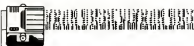
Dimensions (HWD): LQ-800,
3.8x16.5x13.2 in.; LQ-1000,
3.8x23.5x13.2 in.

Weight: LQ-800, 13.2 lbs.; LQ-1000, 17.6 lbs.

Made in Japan

In Short: A 24-pin dot matrix printer, with normal- and wide-carriage versions, that produces beautiful type quality fairly quickly.

CIRCLE 111 ON READER SERVICE CARD



DOT MATRIX—\$799

computer setups is a breeze in all but the most-cramped quarters.

The only difference between the LQ-1000 and the LQ-800 other than carriage width is the cost of the optional tractor-feed mechanism and sheet-feeder, which obviously increase in size directly with carriage width. The printers come with both serial and parallel interfaces. A top compartment holds optional identity cartridges and fonts. You select both the draft and near-letter-quality fonts from the panel buttons or by using software.

Unpacking and setting up the LQ-800 and the LQ-1000 are easy—only a matter of minutes. At first, I was dismayed to find no tractor-feed or even guiding pins, since I usually use tractor-feed paper or forms, but I was surprised and pleased to find that the friction-feed on this printer works better than any other I've seen. My paper didn't slip once. And since I've never been enamored of Epson pin-feed mechanisms anyway, this very functional friction apparatus was a pleasant surprise. (If you really need one, a tractor-feed is available for \$59.95 for the LQ-800, and for \$69.95 for the LQ-1000. A single-sheet-feeder costs \$129.95 for the LQ-800 and \$189.95 for the LQ-1000.)

The LQ-800 will take only continuous form or cut-sheet paper up to 10 inches wide. The LQ-1000 will accommodate 14.3-inch-wide cut sheets and 16-inch friction-feed paper. The extra 6 inches can be very important. If you're using the LQ-1000 to print spreadsheets, for example, it will print 14 nine-character spreadsheet columns in pica type (136 characters) as opposed to the LQ-800's 8 columns (80 characters, but only 72 will print if you don't adjust spreadsheet column width). In the smallest print mode (condensed elite), the LQ-800 will print 160 characters, and the LQ-1000, 272 characters. That's 17 standard spreadsheet columns with the LQ-800 versus 30 columns with the LQ-1000. Heavy users of spreadsheets who love tiny print will undoubtedly choose the LQ-1000 over the LQ-800 in a snap.

The Epson manuals are now famous for their clarity and completeness, and the manual for the LQ-800 and the LQ-1000 is no exception. Epson also includes a durable plastic quick-reference card bound into the manual.

Arguing about letter quality, near-letter-quality, correspondence mode, and so forth becomes rather moot after awhile. On close inspection, most informed people can tell the difference between print produced by dot matrix printers, full-impact daisy wheel printers, and laser printers. What turns out to be more important is the overall appearance of the print. The type produced by the LQ-800 and the LQ-1000 is an example of "better-than-just-good-enough dot matrix near-letter-quality" print. That's good enough for me.

As expected, the LQ-800 and LQ-1000 are graphics compatible with a whole raft of Epson printers, including the MX-80, FX-80, FX-85, and LQ-15000. In addition, they're text compatible with both the Epson MX-80 and the IBM Proprinter. As delivered, the LQ-800 and LQ-1000 will not print the IBM PC high-order character set. "Identity" cartridges are available that will make both printers emulate an IBM 5152 Graphics Printer or a Diablo 630. The emulation cartridges are reasonable at \$89.95 each, for those who need those specific emulations. Optional font cartridges cost \$59.95 each.

The Epson LQ-800 is slim, trim, moderately fast, and it produces great print. The wide Epson LQ-1000 is a rugged little printer that delivers very good performance. If you want the print quality possible with the Epson LQ series but also need a wide carriage, the \$300 difference between the LQ-800 and the LQ-1000 may be worth it. All in all, the Epson LQ-800 and the Epson LQ-1000 are each one heck of a value. —Bruce Brown

IBM Proprinter XL

In last year's printer issue, the IBM Proprinter was selected an Editor's Choice because of its fine design and ratio of price to performance. This year Big Blue gives you more of the same with the IBM Proprinter XL, a wide-carriage version of last year's model. Besides its wider carriage, the Proprinter XL's major selling points are its ability to take single sheets while continuous forms remain in place, a highly legible near-letter-quality typeface, and a throughput of almost 120 characters per second in draft mode.

The Proprinter XL was designed with



IBM Proprinter XL

IBM Corp.
Contact your local authorized IBM dealer.
List Price: \$799
Dimensions (HWD): 5.25 x 22.6 x 14.3 in.
Weight: 23.6 lbs.
Made in U.S.A.

In Short: A dot matrix printer that gives you highly respectable output with convenience, style, and speed.

CIRCLE 148 ON READER SERVICE CARD

the user in mind. If you need to access a DIP switch, simply remove a plastic cover on the side—no more groping behind the printer or cable shifting. The parallel and power cables are far enough apart so that rear-fed paper does not get caught, torn, or jammed during printing. Even the printer's bell is more of a soft chime than a shrill buzz. True, the recessed power switch on the unit I tested does not have enough room around it, making powering on and off slightly awkward, but I suspect this is as far as design problems go.

While feeding letterhead and envelopes through the front of the printer without disconnecting the form-fed paper is a dream, you do sacrifice a few forms with each sheet you feed. Also, since the printer does not automatically pause to allow you to insert another sheet of paper, it prints the second page of text on the continuous forms. If you're using standard paper, the convenience more than offsets the loss of a few sheets. But if you're using expensive customized forms, the loss of paper may be less negligible.

In general, the Proprinter XL's typeface is more than respectable—in fact, you'd be hard pressed to find another dot

(continues)

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through November 30, 1986

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Remember Andrew Tobias? He wrote some great books on how to make money without really trying. Also, he wrote a best-selling home financial program, which is now into its third version! If you have any trouble managing your money (pardon the pun), then you might do well to give this one a try. Includes all the features and sections from previous versions, plus:

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• Squire	36
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PC Connection Hardware Special

through November 30, 1986

KRAFT

Kraft Joystick

Okay, okay, joysticks are for kids. I mean, remember Pong? Well, home computers have progressed slightly since then, and so have joysticks. You never saw anything like Flight Simulator on an Altan 2600, and it can even make your life with Lotus easier to bear with Executive Cursor Control.

- Two fire buttons (one red, one black)
- Stick will self-center or float free
- Includes 8-foot cord

For the IBM PC, XT, AT (requires game port, see below) \$27

Kraft 3-Button Joystick

If you thought a regular joystick was just the bee's knees, look at this one. Three fire buttons, including one up on top of the control stick. Move on over to that offending spreadsheet cell and ZAP! it's gone! Or more conventionally, use it to shoot down enemy planes in the Jet World War II simulation.

For the IBM PC, XT, AT (requires game port, see below) \$33

Kraft Executive Cursor Control Software

Software that lets your joystick think it is a mouse.

- Drivers included for 1-2-3, MultiMate, PFS: Topview, and a variety of other applications programs
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Adds a game port to a standard PC.

- Works with any brand PC-compatible joystick
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OR Buy the Kraft 3-Button Joystick and the Game Control Adapter for only \$59.

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Chess 2001 \$25

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Black Cauldron \$25

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King's Quest II \$33

Simon & Schuster

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Sir-Tech

Wizardry \$36

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Orbiter (Shuttle simulation) \$27

GATO \$27

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Flashpak (accelerator board) ... 369

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copy-protected and DESQView ... 369

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piggyback board; EEMS compatible, includes

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1-800/243-8088



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6 Mill Street

Marlow, NH 03456

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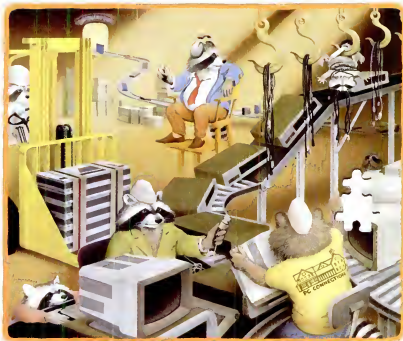
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DOT MATRIX—\$799–\$899

(continues from page 186)

matrix printer with characters so clear and sharp. The Proprietary XL comes with the standard dot matrix print enhancements, and you can set it from default to NLQ mode from the front panel. Unlike some printers, you can use the NLQ mode with other features, such as proportional, elite, and emphasized print.

Two other print enhancements worth noting are the high print and the overscore. The high print font is useful for titling or drop-in initial letters, and the overscore, while it does interfere with ascenders and uppercase letters, works like a charm in conjunction with the underscore. By sending both features simultaneously, you can create horizontal double lines that are certain to enhance your output's headings.

The Proprietary XL gets my vote for a highly functional, friendly printer. IBM may not want to be in a commodity market, but when it puts out a printer as easy to use as the Proprietary XL, that's what it's selling—a valuable commodity you can take off the shelf and use immediately.

—Vincent Puglisi

Seikosha MP-1300AI

The Seikosha MP-1300AI, a seven-color, 9-wire, 80-column dot matrix printer, does exactly what it's supposed to do: it has good speed, it's not too loud, it prints reasonable color graphics, and it emulates the Epson printer family and the IBM 5152 Graphics Printer and Proprietary. In addition, the Seikosha comes with a unidirectional tractor-feed for continuous forms and has a safety auto-load feature for single-sheet paper.

Preparing the Seikosha for use is simple, unless you have the optional color feature. In that case you must cross-reference two manuals, which is somewhat awkward. The main manual, though, is a joy to use. It includes very clear descriptions and instructions and plenty of examples of how to use the printer's functions, including examples of color printing. It also has an *Introduction to Printer Features for Beginners*. What a great idea! This manual should stand as a model for others.

The Seikosha moves right along in both letter-quality (41 characters per second) and draft (119 cps) modes. Print quality is



Seikosha MP-1300AI

Honori Seiko Computer Peripherals

1111 MacArthur Blvd.

Mahwah, NJ 07430

(201) 529-4655

List Price: \$799 for basic printer; \$155 for color unit

Dimensions (HWD): 5.5×18.5×4.1 in.

Weight: 18.8 lbs.

Made in Japan

In Short: A good-quality 9-pin dot matrix color printer with an exceptional manual.

CIRCLE 666 ON READER SERVICE CARD

acceptable, but the Seikosha's 9-wire head is a limitation for those who want excellent near-letter-quality output from a dot matrix printer.

The Seikosha is as IBM compatible as it can get, having no trouble printing both the lower- and higher-order character sets. In text-compatibility testing the Seikosha printed just like the IBM 5152 Graphics Printer and the Epson MX-80. Graphics compatibility included the Epson MX-80, LX-80, JX-80, FX-80, FX-85, and the IBM 5152 Graphics Printer and Proprietary.

With its color option, the 9-pin Seikosha MP-1300AI costs \$950, but for about \$450 more, the 24-pin wide-carriage Fujitsu DL2400 delivers much better draft and letter quality type, emulates the Diablo 630, uses an easy feature menu instead of DIP switches, and accepts cartridge-load fonts.

Although there's really nothing wrong with the Seikosha, the \$1,395 Fujitsu DL2400 does it better and offers more features. But if breaking \$1,000 takes you over budget or if you have no convenient

place to buy the Fujitsu DL2400, the Seikosha MP-1300AI is a fine substitute.

—Bruce Brown

Genicom 1020

The new Genicom 1020 printer is like a genie who promises to grant your every wish. If you wish for type styles, ten plug-in font cartridges are set to serve you. If you wish for compatibility, six printer emulations respond to your commands. If you wish for special paper handling, fanfold and single-sheet paper work for you in harmony. And an optional color kit can make all your chromatic longings come true.

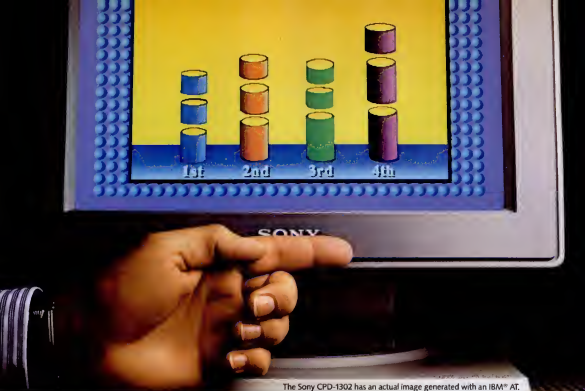
The Genicom 1020 looks more like a spacecraft than a genie, especially when the legs of its hidden printer stand are lowered and its upper body is raised, like a clamshell, to insert paper into the integral tractor-feed mechanism. But with the legs hidden underneath and the top of the unit in its normal position, the Genicom 1020 looks solidly built and distinctly modern. The rear of the printer is twice as high as the front, with a sloping top and touch-sensitive control panel.

The printer's \$99 personality module gives the printer, as the name suggests, a distinct personality, which may be one of six emulations of IBM PC graphics printer, IBM PC color graphics, Epson FX/JX, Diablo 630, or Genicom (serial or parallel). Additional personality modules cost \$85 each.

Print quality is very good. The printer comes with one plug-in font cartridge but can hold as many as three at one time. You can switch among fonts either by pressing a button on the printer's front panel or through software. Additional font cartridges are \$35 each. The print quality in graphics mode is the only drawback; graphics have a tendency to smear.

The printer tested at 111 characters per second in draft mode and 73 cps in letter quality mode. In letter quality mode, the 1020's 18-pin printhead prints in one pass. The only time the sound—average for a daisy wheel—approaches an irritating level is when printing graphics, when it's a high-pitched squeal.

Putting the Genicom 1020 into operation is fairly easy. The two manuals, one for the printer and the other for the person-



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Sony WPH-102001 & WPH-203001
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DOT MATRIX—\$899



FACT FILE



Genicom 1020
Genicom Corp.
One Genicom Dr.
Waynesboro, VA 22980
(800) 437-7468
(703) 949-1000

List Price: \$899, plus Personality Module
starter kit for \$99
Dimensions (HWD): 10×24.4×16.4 in.
Weight: 39 lbs.
Made in U.S.A.

In Short: A dot matrix printer that offers innovative features and good text quality, but it has some problems with graphics and paper feeding.

CIRCLE 688 ON READER SERVICE CARD

ality module, are both well illustrated, clear, and informative. Inserting the ribbon is a straightforward though slightly ink-staining process. Paper can be fed through the printer's bottom by using the tractor-feed mechanism or through its top by using friction feed. The Genicom 1020 can print on single-sheet paper or on envelopes without necessitating removing fan-fold paper loaded in the tractor-feed mechanism.

The Tear-Off Position pushbutton aims to save time and paper; it automatically advances the paper about an inch, so that you can tear it using the edge of the paper shield. Then about 15 seconds later, the paper retracts to its original position. Unfortunately, the paper bail lifts automatically until paper begins feeding again. Often, the paper-bail release is not properly synchronized to the advancing paper so that the paper feeds back into the printer (under the paper guide) instead of out.

Overall, the Genicom 1020 is capable of granting most of your wishes at a competitive price. But if you want to print

graphics and use the Tear-Off Position pushbutton, the smeared graphics, and problem with the paper feeding back into the printer may make you wish for a different printer. —**Joe Desposito**

TI 857

The versatile TI 857 is positioned a notch above most mainstream dot matrix printers. It features superb near-letter-quality mode, cartridge-loaded character fonts, and color printing. The 857 is not super fast, but it prints at a respectable 96 characters per second.

In an industry that hasn't much history, the 857 carries on a tradition started in 1984 when Texas Instruments first introduced the TI 850, which was the first dot matrix printer many attorneys deemed good enough for correspondence use. The TI 857 is not as revolutionary as the 850 was; it's merely a fine printer with additional features from a company that has a winning track record.

The only difficult part about preparing the 857 for use is loading the ribbon, which is probably why Texas Instruments includes two plastic gloves with the cartridge. The 857's color ribbon is only marginally more difficult to install than most cartridge ribbons, since ribbon placement is more critical with a printhead that must be able to accurately find different bands of color on an already-narrow ribbon.

Other than ribbon loading, setting up the 857 is uncomplicated, assisted by a superior operator manual and technical reference manual. Both volumes have clear printing on quality paper, precise illustrations, and helpful indexes. A comprehensive quick-reference card is also included.

The 857 is easy to use. The printer has two different personalities, or modes—data processing and word processing. The only functional difference between these two modes is the different command sets followed. Although it is never clearly stated in the documentation, in data processing mode the 857 follows Epson commands, and in word processing mode it imitates a Diablo 630. By covering both sets of commands, the 857 is almost a sure bet to work with most PC applications software. You select the printing mode using a DIP switch that is conveniently located on



FACT FILE



TI 857
Texas Instruments Inc.
Data Systems Group
P.O. Box 809063
Dallas, TX 75380-9063
(800) 527-3500

List Price: \$899; with automatic sheet feed, \$1,399
Dimensions (HWD): 5×16.2×13.5 in.
Weight: 17 lbs.
Made in U.S.A.

In Short: A dot matrix printer that offers reasonable speed, a great near-letter-quality mode, decent color, and cartridge fonts.

CIRCLE 689 ON READER SERVICE CARD

the inside bottom of the printer.

In either mode you can select draft or near-letter-quality printing. Draft printing for quick jobs and rough drafts is more than three times faster than NLQ mode. NLQ mode is slow, but the type is good enough for all but the most important letters or legal documents.

You set draft or NLQ print through a top-panel switch block that controls much of the printer's operation. It also includes controls for characters and lines per inch, as well as the more common switches for line-feed, form-feed, top-of-form, and on-line. The panel control switches are easy to reach and clearly marked, but they are flat panel, or membrane, switches which require too much pressure to register.

The 857 includes color-printing ability. The standard sample we printed used the correct colors, but they were not as bright and deep as those produced by some other, admittedly more-expensive printers. The color quality is probably adequate for printing occasional charts and graphs.

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\$4000	\$156

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- IBM graphics character set built in
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- 80-column narrow carriage for correspondence
- Switch from draft to Near Letter Quality mode with the push of a button
- 8K internal buffer allows you to keep working on your computer while the printer is printing



FX-286™

- Prints at a fast 200 characters per second printhead speed in draft mode; 40 characters per second in Near Letter Quality mode.
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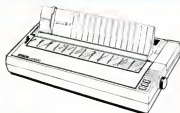
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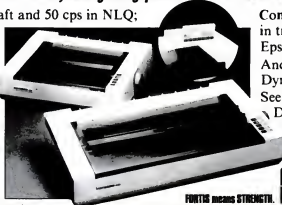
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CIRCLE 173 ON READER SERVICE CARD
PC MAGAZINE ■ NOVEMBER 11, 1986
200



The TI 857 uses a 9-pin printhead to its best advantage. When you take into account the TI 857's print quality, ability to access different fonts, and the company's track record as well as its price, the 857 commands respect and serious consideration.—**Bruce Brown**

Panasonic KX-P1595

If versatility is your cup of tea, then using the Panasonic KX-P1595 dot matrix printer will be like sipping fine Earl Grey. Panasonic's new top-of-the-line machine turns out superior dot matrix print in an impressive variety of fonts, pitches, character sets, and styles.

The KX-P1595 comes with five distinct printer modes: standard, which emulates the Epson FX series; IBM PC dot matrix mode, which includes block graphics; two IBM PC graphics modes, the second of which includes all the ASCII high-order characters; and daisy wheel printer mode, which emulates the Diablo 630 printer. Since the KX-P1595 also allows for such standards as near-letter-quality, underlining, and italic type, the number of possible combinations is a challenge to the imagination. Of course, all this variety doesn't do anyone any good unless the type quality is up to par. The default 10-pitch draft quality type is only fair, but I wouldn't hesitate to use it for draft and informal copies. The near-letter-quality type is a different story: clear, sharp, and as close to fully formed type as I've seen in a dot matrix. In graphics mode the KX-P1595 emulated the Epson's performance with no perceivable qualms.

The PC Magazine Labs speed test rated the KX-P1595's draft speed at 123 characters per second and NLQ speed at 42 cps, both decent ratings among comparably priced printers. And while the sound level rates a medium-high 79 decibels, the low hum is much more tolerable than shriller hums made by many quieter models.

The utilitarian-looking machine has touch-sensitive membrane switches that run along the front panel and control pitch and font. The panel also includes standard line-feed, form-feed, and on-line switches; indicator lights; and a dial that adjusts for ten different paper lengths. The small, snap-in cartridge ribbon took me about 3



Panasonic KX-P1595

Panasonic Computer Products Div.

Two Panasonic Way

Secaucus, NJ 07094

(201) 348-7000

List Price: \$949

Dimensions (HWD): 6.1 x 24 x 15.4 in.

Weight: 32.4 lbs.

Made in Japan

In Short: An extremely versatile dot matrix printer that offers an excellent near-letter-quality format with a good choice of fonts and pitches in a variety of combinations.

CIRCLE 699 ON READER SERVICE CARD

seconds to install. The printer comes with two separate, removable covers: one in the front protecting the printhead and another in back covering the tractors. The paper separator did not prevent the machine from occasionally trying to feed back into itself. The printer has both parallel and serial ports and a convenient reset switch on the side. Since most changes in character sets are implemented by alternating the first three DIP switches, the switches have been placed where they are relatively easy to reach—on the back of the machine.

Panasonic has obviously taken some pains with its manual, which leads off with a clearly written description of the KX-P1595's capabilities and functions and has well-organized instructions on entering the necessary control codes. But an index would have been welcome.

In programming the printer for all the possible combinations, Panasonic made some tradeoffs. To "make room" for the daisy wheel mode, for example, the company left out control code capabilities for variable line heights and justified and centered type. According to a company repre-

sentative, Panasonic decided that anybody buying a \$949 printer would have software that could take care of these functions—a fair assumption, but one that you should be aware of.

The Panasonic KX-P1595 is a superior printer that more than justifies its price with its wide range of print capabilities and well-formatted NLQ type. Businesses that need to produce documents in a variety of fonts and formats will want to consider the KX-P1595 very carefully indeed.

—**Barbara Krasnow**

ALPS P2000

Literally dozens of competent dot matrix printers are available for less than \$1,000. I expected the ALPS P2000 to be another slick Japanese printer that did just about everything the others do just about as well. Was I surprised!

With only a 9-pin printhead the P2000 offers superior print quality—better even than that of its 18-pin sibling, the P2100. The P2100 is faster—173 characters per second versus the ALPS P2000's 138 cps in draft mode—but, in theory, that speed increase should also be accompanied by a significant print quality improvement. It isn't.

Installing the ALPS P2000 is very easy, especially when you use the fine manual. During installation and setup, I discovered that both ALPS printers share one of my favorite features: bidirectional form-feeding. I have a strong bias about tractor-feed mechanisms; I think they should be easy to load and should work smoothly. Just as important to me is the ability of a tractor to work both ways. As soon as you start rolling paper backward with a unidirectional tractor, the paper starts to bind. You'll find that the only way around this problem is to reach behind the printer and gently pull the paper backward while reversing the paper-advance knob. Bidirectional tractors let the paper go both ways. Usually they have two sets of clamps, one to push and another to pull.

ALPS has a different solution to the tractor problem. Instead of using a double-clamp tractor or opting for single-direction feeding, the ALPS tractor has two positions and separate paper paths for those positions. If you want bidirectional feeding,

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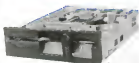


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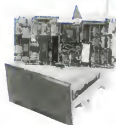


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ALPS P2000

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San Jose, CA 95134
(408) 946-6000
List Price: \$995
Dimensions (HWD): 5.5×24.4×16.5 in.
Weight: 33 lbs.
Made in Japan
In Short: A fast, quality dot matrix printer with convenient features and attractive type.
CIRCLE 608 ON READER SERVICE CARD

you flip a lever and the tractor drops down to become a push-type tractor that works in both directions. If you work with multipart forms and need a pull-type tractor, just leave it in its horizontal position. This design is one of those "Why didn't I think of that?" ideas.

The ALPS P2000 has a front operations panel that controls on-line/off-line, form-feed, line-feed, and top-of-form functions and also lets you move the paper up by 1/16 of an inch or down by half-line increments. The ALPS P2000 has a copy buffer (4K-byte standard, expandable to 260K) that can be used to reprint data stored in the buffer. A reset button clears the buffer.

The ALPS manual is terrific. It includes exceptionally clear and complete descriptions and explanations of everything you need to know about installing and using the printer.

The ALPS P2000 is text compatible with the Epson MX-80 and IBM Proprinter and graphics compatible with the Epson MX-80, FX-80, and FX-85 and the IBM 5152 Graphics Printer and IBM Proprinter. The ALPS P2000 prints both the low- and the high-order IBM PC character sets.

The ALPS P2000 is a solid value for

just under \$1,000. It gives you speed, good type quality, versatility, Epson and IBM compatibility, and rugged, thoughtful design. What more can you ask for in a dot matrix printer?—**Bruce Brown**

NEC Pinwriter P7

There is something very comfortable about NEC's printers, even a bit old fashioned. The NEC Pinwriter P7 is a good example: instead of the touch-sensitive membrane switches and elaborate programming systems that have become so popular lately, it still uses plastic buttons and hidden DIP switches. However, with all that, it compares very favorably to many of its "updated" peers.

The Pinwriter P7, a wide-carriage version of the Pinwriter P6 (which *PC Magazine* was unable to test) is a sturdy dot matrix printer. It comes with two well-organized and understandable manuals, and uses a platen-wide ribbon that snaps in easily (although I must admit I prefer ribbons that expose your hands to less ink). It accepts both single sheets and fanfold paper; the latter is directed through the platen by friction alone, since the P7 uses no tractor- or pin-feed mechanism. The DIP switches are located beneath the printhead—they are accessible, but obviously meant to be used sparingly.

NEC makes its various print modes easily available through a Font switch placed, with the other switches, along the side of the printhead cover. It allows you to cycle through ten different letter-quality and draft-quality print modes. A small LCD panel that exhibits the number of the current mode is located between the DIP switches and a Font Indicator Label that lists the available fonts.

Unfortunately, the panel tends to be obscured by the printhead: I found that I had to open the cover and actually physically move the printhead more than once—an operation that is certainly not advisable if the printer has been in operation for any length of time.

In deference to the considerable racket that several printers can make in an office environment, NEC has added a Quiet mode to the P7 (which is not, by the way, a loud printer in normal operation). In *PC Magazine* Labs sound-level tests, the 70

PC
MAGAZINE

FACT FILE



NEC Pinwriter P7

NEC Information Systems Inc.
1414 Massachusetts Ave.
Boston, MA 01719
(617) 264-8000
List Price: \$995
Dimensions (HWD): 4.9×22.4×13.1 in.
Weight: 24.3 lbs.
Made in Japan
In Short: A sturdy, quiet, fast dot matrix printer that produces a well-fashioned quality type.
CIRCLE 603 ON READER SERVICE CARD

decibels we measured for the printer's near-letter-quality print (which is its default mode) dropped to 67 decibels while the Quiet mode was active. Unfortunately, this mode also slows the printer to such an extent that I doubt most businesses would find the decrease in noise level a reasonable trade-off.

The draft type, which we clocked at a respectable 99 characters per second under normal conditions, dropped to 44 cps during Quiet operation, while near-letter-quality mode crawled at 23 cps.

If you're in a hurry, NEC has included a high-speed draft mode, which produces a 12-character-per-inch, somewhat condensed draft type at 111 cps. It isn't anything you'd want to show to your boss, but might help allay the panic in a deadline situation.

The Pinwriter P7's draft and NLQ type modes are both quite acceptable for a professional impact printer. The latter produces well-defined, slightly thick characters in a typewriterlike font that is suitable for most business applications.

All in all, NEC's Pinwriter 7 is not a bad printer to have around the office, especially if you are looking for something quick and quiet.—**Barbara Krasnoff**



Mannesmann Tally 290

The Mannesmann Tally 290 may be the first truly heavy-duty printer for under \$1,000. Its better points include speed, good print quality, and an apparent ruggedness. It's also one of the more versatile printers I've seen, with a bagful of tricks that puts most other printers to shame.

My first hint that the MT 290 might be special came while I was setting it up. The PC Magazine Labs tests clock a typical dot matrix printer at roughly half its rated speed. By that rule of thumb, the "200-character-per-second" MT 290 should come in at about 100 cps. But even before printing anything I began to suspect otherwise just from the authority with which the printer handles paper on a form-feed. Sure enough, the MT 290 clocked in at 132.8 cps. That doesn't put it next to, say, the Okidata 2410 Pacemaker, but it certainly puts it high on the list in its price range. Even in near-letter-quality mode the MT 290 does well, with a claimed 50 cps and a measured 35.9 cps.

Print quality is also impressive. Draft mode is obviously produced by a dot matrix printer, with each dot standing alone, but the output is more readable than with some printers' so-called letter-quality output. And the NLQ text is that much better. I would almost call it true letter quality, except that the characters are clearly the product of a dot matrix printer, even though you can't make out the dots.

The "dot matrix" effect in NLQ mode is subtle. I had to examine the text carefully before I realized it is mostly a result of the short descenders and ascenders on the lower case *g*, *y*, *p*, *q*, *d*, and *b*. The problem, in brief, is with the shape of the letters rather than with any lack of quality in printing them. And judging by the print samples in the manual, even this problem disappears with some of the optional font cartridges. I would certainly not hesitate to use NLQ mode for correspondence.

One option worth mention is an automatic front feeder. This gadget lets you feed individual sheets without removing the tractor-feed paper. And unlike the way you have to use the front feed on IBM's



Proprinter, you can print the individual sheets without feeding, and wasting, paper on the tractor feed.

On the minus side is the MT 290's noise level. Its deep-throated 79 decibels isn't the loudest I've ever heard, but it's far from a whisper. Don't expect to make phone calls while the MT 290 is printing.

On the below-minus side is the MT 290's documentation. Printer manuals are among the worst in the industry, and yet the MT 290 documentation sets a new record for obfuscation. All the information you'll need is there. It's not even hard to find. But making sense out of it is something else again.

According to a Mannesmann Tally spokesman, the manuals were written in German and then translated into English by Germans. That explains a lot. Unfortunately, it doesn't explain what some of the puzzling sentences mean. Mannesmann Tally is aware of this problem and says that the manuals are currently being rewritten. And, fortunately, the company offers an 800 number for help.

Even with its rotten manual, the MT 290 offers a lot for the price. If you're light on experience, you'll want to be sure you

have good dealer support. But if you've got either the experience or the support, you'll want to get the hard-to-beat Mannesmann Tally 290.—*M. David Stone*

TI 865

The TI 865 is a member of Texas Instruments' successful family of microcomputer printers. TI's first printer to attract attention was the Model 850, introduced in 1984. The TI 850 was notable because of two features: terrific near-letter-quality print and changeable font cartridges. The TI 855 was the first PC dot matrix printer to use interchangeable font cartridges. Users who wanted different fonts were previously limited either to using daisy wheel printers with an assortment of print wheels or to programming their own user-defined graphics to invent new fonts.

The TI 865 carries on the TI tradition of superb NLQ print. Other dot matrix printers on the market now print as cleanly and clearly as the TI 865 or even better, but they're usually 24-pin printers that cost significantly more.

The TI 865 has two different modes, word processing and data processing. You can control draft and NLQ type from either mode. In data processing mode, the printer responds to Epson escape codes; in word processing mode, it follows Diablo 630 escape codes. The TI 865 is compatible with Diablo 630, Epson MX-80, and IBM Proprinter text printing and with Epson MX-80, FX-80, and FX-85 graphics printing as well as the TI 855 and 857.

You control most of the options from a top-mounted control panel. The only reason to change the rear-mounted DIP switch settings is to set the power-on default to word processing or data processing mode, which also can be changed by programming. The TI 865 uses membrane pushbuttons on the top panel, which you have to press very hard to activate (it's inconvenient when you have to press a switch several times before it recognizes that you want it to turn on or off). With these buttons you can select double-spaced lines, pitch, font module, line spacing, form length, and draft or NLQ print—a terrific amount of control to have at your fingertips (even if you have to press hard).

If no font modules are plugged into the



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The TI

865 is a contender for your printer dollar.

printer, an internal 10-character-per-inch draft font is the default. You can have up to three font modules at once plugged into the printer. With an optional downloadable font feature, you can also access a user-defined font at the same time as you use the cartridge-loaded fonts. Most font cartridges have three pitches.

The TI 865 prints at 96 characters per second in draft mode and 31 cps in NLQ mode, both minimum acceptable speeds for today's dot matrix printers. Its two manuals, an operator manual and a technical reference manual, are very good. A comprehensive quick-reference card is also included.

Two years ago this printer would have

been big news; today it's one of several fine printers in its class. But its NLQ virtues combined with its ability to use different fonts, its overall versatility, and its reasonable price make the TI 865 a contender for your printer dollar. —Bruce Brown

Centronics Printstation 260

Any new printer from Centronics Data Computer Corp. stirs interest. Centronics, which traces its lineage as one of the first independent printer companies to 1968, defined the standard parallel interface between printers and PCs. Its latest entry, the Centronics Printstation 260, is a modularly designed dot matrix color printer that emulates the IBM 5182 Color Printer.

The Printstation 260 incorporates what Centronics calls a P (for "personality") card that controls the printer interface and the emulation. Centronics currently has two P-card versions: the 8510 P card and the HAL P card. The Printstation 260 I tested in the PC Magazine Labs used the HAL P Card, named for the on-board computer in the movie *2001: A Space Odyssey*. The HAL P card lets you emulate the IBM 5182 Color Printer and the IBM 5152 Graphics Printer (see what happens if you replace each letter in HAL with the next letter in the alphabet?). The HAL P card also allows the Printstation 260 to connect to the PC through a parallel port. The other P card, the 8510, connects to the PC through a serial port and emulates the C. Itoh 8510. In addition to the P card, a C card in every printer controls command execution.

If you think that's confusing, try setting printer modes. To make your choices, you respond to four-character commands by pressing one of three buttons (labeled Enter, Step, and Menu) located on the front panel of the printer. To make matters worse, the command set is sequential, and so you must sift through prompts for all the modes until you reach the one you want (although you can reverse directions with yet another code). The process is so confusing that the manual includes a four-page flowchart to explain the commands. And because Centronics continues to upgrade this recently released printer, the settings



FACT FILE



Centronics Printstation 260

Centronics Data Computer Corp.

One Wall St.
Hudson, NH 03051
(603) 883-0111

List Price: \$1,095

Dimensions (HWD): 8×24×14.5 in.

Weight: 20 lbs.
Made in U.S.A.

In Short: A dot matrix printer that produces sparkling color output but offers less IBM graphics compatibility and slower speed than many standard dot matrix printers.

CIRCLE 887 ON READER SERVICE CARD



FACT FILE



TI 865

Texas Instruments Inc.
Data Systems Group
P.O. Box 809063
Dallas, TX 75380-9063
(800) 527-3500
List Price: \$999

Dimensions (HWD): 5.5×23×16 in.

Weight: 20 lbs.
Made in U.S.A.

In Short: A versatile, easy-to-use dot matrix printer with great print quality, moderate speed, and cartridge-loaded fonts.

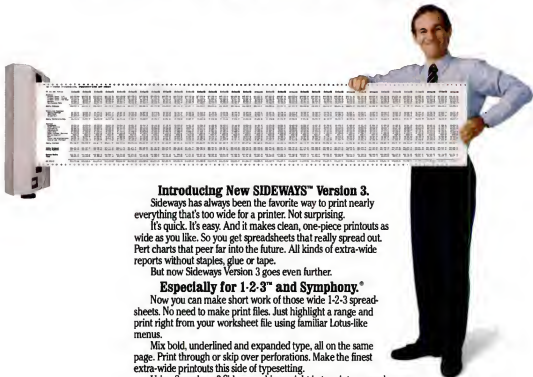
CIRCLE 888 ON READER SERVICE CARD

occasionally diverge from those in the manual. Even worse, the documentation is poorly written and organized. Most people will be happy to leave the controls to their applications software.

The Printstation 260 supports the full IBM character set for graphics printing. The printer's IBM 5182 Color Printer emulation makes it cut out to do a lot more than standard dot matrix printing. In the IBM-emulation high-resolution mode (168 by 168 dots per inch), the Printstation 260's four-color print ribbon produced a picture-perfect multicolor band. Unfortunately, the IBM 5152 Graphics Printer emulation was less laudable. The results of the graphics printing showed faint white lines, instead of solid black space, when a line-feed occurred. Text was less than compatible as well; the printer generated additional line-feeds during the vertical-spacing tests.

The Printstation 260 currently comes with a resident Courier font (Centronics says it plans to replace it with a pica font this fall). The printer includes a slot for optional Centronics font modules, but the only module currently available is a bar-

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CIRCLE 317 ON READER SERVICE CARD



DOT MATRIX—\$1,095–\$1,295

code font (\$125). By the time this review appears, an OCR A font should also be available.

Although the Printstation 260 delivers quality color printing, its problems with IBM graphics emulation tarnish its reputation. Improvements to this area will make it a far more attractive machine.

—Richard W. Ridington, Jr.

Brother Twinriter 5

Should you buy a dot matrix printer for speed and versatility or a daisy wheel printer for variety of print wheels and polish? The most common solution to this familiar dilemma has been either to buy one of each or to mortgage the house and buy a laser printer. No more: the Brother Twinriter 5 packs both a 9-pin dot matrix printhead and a cartridge-mounted daisy wheel into a single, clean-cut case.

That's unorthodox engineering, and if you're like me you're probably wondering if this hybrid beauty might turn out to be a two-headed beast. But after you wrench

the 35-pound, putty-colored printer out of its box and onto your desk, connect it to your parallel port (serial is an option), and print a screen, you'll be hard-pressed to hold back a grin. With the PC Magazine Labs logo and a menu of benchmark tests displayed on the screen, I gaped as the Twinriter 5 adroitly sketched the PC Labs logo with its dot matrix printhead and then flicked on the daisy wheel to hammer out the menu in flawless letter quality.

The Twinriter 5 can accomplish this feat because its on-board software knows the difference between standard ASCII characters and graphics and automatically delegates the task of printing each to the most appropriate printhead. If you're using one of the integrated packages capable of printing graphs and text on the same page, take note: here's a lower-cost alternative to a laser printer that allows you to print those graphics without sacrificing true letter quality text.

Surprisingly, I encountered few catches to this alternative. The Twinriter 5 supports two command sets: Diablo 630 for text and Epson FX-100 for graphics. It breezes through the PC Labs benchmark tests with only minor compatibility problems and produced measured speeds of 77 characters per second using its dot matrix printhead and 33 cps using the daisy wheel.

Aside from the job of getting it out of its box, setting up the Twinriter 5 is simple. Just as the Twinriter 5's rock-solid 35-pound weight flies in the face of the trend toward ever-lighter construction, its oversized, 172-page illustrated user manual is an oasis of completeness and clarity in a desert of confusing printer documentation.

Graphics quality is on a par with any 9-pin Epson, and like those machines, the Twinriter 5's dot matrix text mode can't compare to the reigning 24-pin hotshots such as the Toshiba P351C. But with the Twinriter 5's daisy wheel to handle your letters, the need for dot matrix near-letter-quality mode diminishes significantly.

The printer feels solid and appears to be well built, although its friction paper-feed mechanism is an exception. The paper continually slid to the right on the platen. For a few extra dollars, a tractor-feed (\$169) or cut-sheet-feeder (\$299) are available to solve that problem, and a

three-bin sheet/envelope feeder (\$599) is due out by the time you read this.

The Twinriter 5 is an unusual solution to a common problem. Combining both dot matrix and daisy wheel print mechanisms and supporting the most widespread standards in the industry, it offers excellent versatility and good speed at a reasonable price. In the near future, falling laser printer prices may make this kind of hybrid obsolete, but for the present, the Twinriter 5 is worth a look.

—Richard W. Ridington, Jr.

Brother 2024L

It was like a sunny day on the sound with just the right amount of wind in the sails. I was sailing along with the Brother 2024L, with fanfold paper in place, ribbon cartridge installed, and everything generally shipshape. And I was getting great print—all without even taking the manual out of the box.

The 24-pin, wide-carriage Brother 2024L was so far, as they say in sailing circles, that it looked like a Japanese chal-



Brother Twinriter 5
Brother International Corp.
Information Systems and Peripherals
Division

8 Corporate Pl.
Piscataway, NJ 08854
(800) 526-3537
(201) 981-0300 (in N.J.)

List Price: \$1,295
Dimensions (HWD): 7.9 × 23.2 × 15.0 in.
Weight: 35.3 lbs.
Made in Japan.

In Short: The low-cost alternative to a laser printer for obtaining letter quality text and graphics on the same page.

CIRCLE 666 ON READER SERVICE CARD



Brother 2024L
Brother International Corp.
8 Corporate Pl.

Piscataway, NJ 08854
(800) 526-3537
(201) 981-0300 (in N.J.)

List Price: \$1,295
Dimensions (HWD): 6.5 × 22.4 × 14.8 in.
Weight: 28.665 lbs.
Made in Japan

In Short: A user-friendly 24-pin dot matrix printer that emulates a Diablo 630 daisy wheel printer in word processing mode but is marred by an inadequate manual.

CIRCLE 665 ON READER SERVICE CARD



Remember the first time you upgraded your color graphics hardware? The thrill is still the same.

The discovery of color graphics. As a child, it was a significant event. As a business person, it will change the way you use your personal computer.

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This means that you don't have to wait around for new

software updates in order to begin enjoying your EGA today.

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The first thing you'll rediscover with your Spectra EGA is color. There is a whole lot more than ever before. Sixty-four separate colors, in fact, from which any sixteen can be displayed at once.

Next, you'll notice a higher resolution in both text and graphics modes.

The real fun comes in putting the board to work. You'll see soft scrolling, panning and windowing that was never before possible on a PC. And the flicker-free display will allow you to regulate these movements at any speed, or in any direction.

There are 512 characters carried in Spectra's memory that can all

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be displayed at once. Which is twice as many as previously possible on a PC.

And if you wish to use other characters, or even create your own alternate character set, Spectra will support those, too.

More colorful features.

Each Spectra EGA comes fully equipped with a parallel printer port, light pen interface and 256K RAM on the single board. This is especially good news because a full 256K RAM is needed to run most popular graphics software effectively.

One thrilling price.

Perhaps the best news is Spectra's price.

Upon first glance you may find that the Spectra EGA and the IBM EGA seem to be very closely priced. But look again. Because the standard IBM EGA only comes with 64K RAM, whereas Spectra EGA comes with a full 256K.

Now, you may purchase the extra memory board you'll need from IBM at an additional cost of about 70-80 percent. Or you can buy Spectra EGA from Genoa...and rediscover the thrill of a bargain.



Spectra Enhanced Graphics Adapter

To find out more about Spectra, or a qualified Genoa distributor near you, call 408-945-9720. Or write to Genoa Systems Corporation, 73 E. Trimble Road, San Jose, CA 95131.

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CIRCLE 239 ON READER SERVICE CARD



lenger for the America's Cup of printing. I tried using some standard escape codes to produce emphasized, shadow, and other print features and met with immediate success. And the letter quality print looked sharp, clear, and well formed. I found I could simply push a button to get 10- and 12-pitch, proportional, and high-speed print, or to put the printer in either data processing or word processing mode.

Designed to be a user-friendly printer that accommodates the needs of users of sophisticated word processing programs, the Brother 2024L aims to come as close as possible to daisy-wheel-quality printing and still offer both the graphics and high speed of a dot matrix printer in the draft mode. In WP mode it emulates Diablo 630, Brother, and Qume daisy wheel printers, and in DP mode it works via a generic Epson-type driver that emulates as closely as possible the Epson FX series.

The Brother 2024L's touch-sensitive

The 2024L's touch-sensitive control panel lets you access the WP and DP modes.

control panel lets you access the WP and DP modes easily, so you can conveniently switch from near-letter-quality print to graphics in the same document at the press of a button. When you need to do high-speed draft printing, you simply press another button. The same goes for switching from pica to elite type and to proportional spacing. All these features can also be activated by using software or by setting the

difficult-to-get-at DIP switches.

The PC Magazine Labs speed tests found rates of about 70 characters per second in DP mode and about 52 cps in WP mode. The printer's sound level couldn't be called unobtrusive, but it isn't particularly bothersome, especially if you're a few feet away from the 2024L.

The Brother 2024L's print looks great in word processing mode—good enough for business correspondence, as if it were produced by a daisy wheel printer—and I particularly like the PS (proportional spacing) font. The high-speed draft font is dotty, as if produced by a less-sophisticated printer, but it's fine for fast printing. The PC Labs logo produced as part of the compatibility test was also rather light and spotty. But the emphasized print and the double strike worked just fine. I was really impressed by the highly readable, reduced-type subscripts and superscripts. All in all, it was smooth sailing—until I fi-

The Canon Bubble-Jet Printer is very compatible with all these units.



nally picked up the subpar manual.

The Brother 2024L deserves a better manual. This one, which a Brother representative tells me is being revised, just served to confuse me about such things as when auto-underlining will turn on and off with the escape code and when it won't (in the 8-bit graphics mode). The inadequate manual, the less-than-perfect graphics, and the Brother 2024L's list price of \$1,295 turned the sea from smooth to choppy and ruined my sailing for the day. —Carol Olsen Day

Fortis DH-45

The Fortis DH-45 is a handsome printer clearly designed for general-office use rather than high-volume printing. Inside the front swing-out cover are its twin printheads. This rather uncommon arrangement lets you print draft material with the dot matrix head and then switch,

under software control or via a touch on the front panel, to fully formed daisy wheel output.

While its flexibility is considerable, the measured speed of the DH-45 is not impressive for a unit in the \$1,200-plus price range. The PC Magazine Labs benchmark timing tests topped out at 76 characters per second for the dot matrix default setting and 31 cps for the daisy wheel head; that's only 5 cps below the manufacturer's rated speed of 36 cps. But for the faster dot matrix head, the measured speed of 76 cps is only 54 percent of the 140 cps quoted by Dynax.

Print quality is quite good. I've seen better-quality printing from other machines, but in each such case they were single-head devices that could not offer the wide range of type styles and formats found in this one unit. This printer is an excellent choice for the space- and budget-constrained user who needs both types of

printers in the space occupied by only one.

The DH-45 is not only an attractive unit, well suited to a modern office, but also relatively quiet. Sound quality is almost as important as level, and the sound of the DH-45 is not at all unpleasant.

The printer is very simple to set up and operate despite the dual-head arrangement. The hardest task is the initial insertion of a ribbon cartridge that measures over 21 inches in width. A multistep pictorial guides you through the process, and once you see how the ribbon fits it's easy to remove and reinstall. Various replacement cartridges are priced from \$18.95 to \$28.95, depending on type and quality.

A first-rate, large, spiral-bound manual takes the first-time user on a nontechnical tour of the DH-45, providing clear illustrations where needed. The printer works right out of the box anyway, but all of the information you need to modify the default settings, switch print modes, and cable to



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For professional word processing, the Near Letter Quality mode (NLQ) churns out crisp, clear copy at a brisk 110 cps. And the BJ-80 has three graphic

image modes for high-resolution printouts of charts, graphs and diagrams.

Of course, the Bubble-Jet is fully compatible with Canon's fine line of Personal Computers and plug-compatible with the IBM PC. It's compact, lightweight and surprisingly affordable.

Ask your dealer about the full line of fast, efficient, economical Canon Printers. Find out what all the quiet excitement is about.

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DOT MATRIX—\$1,295–\$1,374



Fortis DH-45

Fortis Computer Systems
A Division of Dynax Inc.
6070 Rickenbacker
Commerce, CA 90040
(213) 727-1227

List Price: \$1,295

Dimensions (HWD): 7.9×23.2×15 in.

Weight: 35 lbs.

Made in Japan

In Short: A well-priced, medium-speed printer combining a 9-pin dot matrix head with a daisy wheel printhead and offering a total of 17 character sets in 14 different fonts.

CIRCLE 88 ON READER SERVICE CARD

the computer is written clearly and simply. All normal settings can be handled by a light touch on the color-coded membrane switches on the front panel. You also have access to a set of DIP switches at the rear to configure a serial interface and modify the power-on defaults.

The DH-45 is definitely worth a look. Two single-mode printers offering all the features of the Fortis DH-45 would cost significantly more. —John Phillips

Tandy DMP-2110

The Tandy DMP-2110, a new high-speed 24-pin printer, answers the needs of those who want industry strength plus versatility at an affordable price. My only reservation in recommending it is that, at review time, the folks at Tandy Corp. were unfamiliar with the printer's features.

The DMP-2110 replaces Tandy's DMP-2100P; it's faster, and unlike the older model, it comes bundled with a well-built, much-needed bidirectional tractor-feed. Despite the improvements, the DMP-2110 will sell for less than its prede-

cessor. Bundling the lightweight tractor-feed with the printer makes the Tandy DMP-2110 aggressively priced.

The DMP-2110 has a wide carriage and a solid frame, the pin-feed sprockets on the tractor are heavy-duty, and the printhead mechanism is enormous. But the large membrane keypad control panel has a loose, mushy feel, and the oversized cat-gut pulley mechanism that turns the ribbon reminds me more of a guitar than a printer.

The DMP-2110 supports both Tandy and IBM modes and produces three character sets: Tandy's set and IBM's character sets 1 and 2. The Tandy character set has an unmistakably angular look. The correspondence mode has both elite and Courier resident fonts, both of which can also print in proportional type. In addition, the printer can store two nonresident, downloadable fonts. All the correspondence-quality fonts are tight and clear. The speed for both Courier and elite printing is a respectable 62 characters per second.

The printer affords you a great deal of control, with all features selectable from three banks of DIP switches or through es-

cape code commands. In IBM mode it is fully compatible with the IBM 5152 Graphics Printer and produces excellent high-resolution graphics. The Tandy mode's repeat function allows you to create repetitive graphics patterns.

Customer support was always pleasant but infinitely circuitous. When I called with questions about the new machine, no one could help. I could forgive this lapse if the DMP-2110 were a revolutionary new printer, but the codes are identical to those of the older DMP-2100P. I'd like Tandy to be able to offer more information about the printer's operation before I would buy one.

—Robin Raskin

Okidata Microline 294

In the attempt to produce a printer that satisfies a variety of business needs, companies occasionally lose sight of the basics. Okidata Corp. seems to have encountered that problem with their Microline 294, a new high-speed, impact dot matrix printer geared toward businesses that need to produce color graphics.

The Microline 294 is sleek, with a cover over the printhead area and another that fits lightly over the platen area. A paper separator hooks onto the back of the printer and keeps the incoming paper apart from the outgoing forms. The printer's four control buttons are located along the front panel, along with alarm and power lights. The machine is guided by what Okidata calls a personality module—a plug-in cartridge that allows you to alter the printer's compatibility to fit that of a variety of computer systems. The module plugs into a small slot at the side of the machine and acts as the RS-232 connection.

Like many of the Okidata printers, the Microline 294 is "programmable"; that is, by hitting the on/off switch while simultaneously pressing the form-feed button, you put it into a mode in which you can easily change default settings.

I've no real complaints with the Microline 294's utility mode, which is roughly equivalent to a good draft print. The PC Magazine Labs test clocked the print speed at a very respectable and quiet 182 characters per second. But the Microline 294's near-letter-quality typeface is coarse and, in my opinion, unac-



Tandy DMP-2110

Tandy Corp./Radio Shack Division
1700 One Tandy Ctr.
Fort Worth, TX 76102
(817) 390-3011

List Price: \$1,295

Dimensions (HWD): 5.9×21.7×15 in.

Weight: 42 lbs.

Made in Japan

In Short: A new high-speed, 24-pin printer that's both sturdy and affordable, but there's no one at Tandy who can answer users' questions.

CIRCLE 89 ON READER SERVICE CARD

MANAGING YOUR CHECKBOOK?
 MANAGING YOUR BUDGET?
 MANAGING YOUR BILLS?
 MANAGING YOUR CASH FLOW?
 MANAGING YOUR TAXES?
 MANAGING YOUR INSURANCE?
 MANAGING YOUR STOCKS?
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nonglare screen. The lines are crisp, the characters sharp, and the colors even, so you're more productive. Controls are located on the front, where you can reach them.

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Reputation. More and more, people are making Princeton Graphic Systems their number one choice in personal computer displays. Because people know Princeton delivers the ultimate in compatibility, reliability, and performance.

best dot pitch EGA monitors.

For the no-compromise enhanced graphics monitors, look for the Princeton Graphic Systems name. Princeton delivers everything you need in a quality EGA display, from crisp, clear, full EGA support to rugged reliability. When you choose Princeton you choose the best.



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CIRCLE 223 ON READER SERVICE CARD



DOT MATRIX—\$1,374-\$1,395



FACT FILE



Okidata Microline 294

Okidata Corp.
532 Fellowship Rd.
Mt. Laurel, NJ 08054
(800) OKI-DATA
(609) 235-2600

List Price: \$1,374

Dimensions (HWD): 5.6×21.4×13 in.

Weight: 16.5 lbs.

Made in Japan

In Short: Inferior type quality and color compatibility problems make this machine a dubious choice for businesses who need a flexible color printer.

CIRCLE 604 ON READER SERVICE CARD

ceptable for any business correspondence. I didn't have to look closely at the printed page to see the white spaces typically left by a dot matrix printer.

The Microline 294 can accommodate a color ribbon, and it produces sharp, clear color graphics. Okidata includes a software package called *CSP (Color Screen Print)* that enables you to dump the contents of a color screen image to the printer in original or an edited form. The program is simple to use, and I was able to quickly print and then alter the colors and dimensions of the PC Labs logo with no trouble and with impressive results.

As a matter of fact, it was lucky that I was able to check the printer's color capacities using *CSP*. According to the people at Okidata, their personality module is configured primarily to be compatible with the IBM 5152 Graphics Printer (and it performed perfectly on the print and color graphics tests). However, they said that while the Microline 294 can be successfully treated as the Epson JX-80 with such software products as Lotus's *1-2-3*, it's not fully compatible in all cases. When I tried to print out the test color bars using the JX-

80 configuration, the pattern had large horizontal gaps; if you plan to use the Microline 294 as a color printer, I'd strongly suggest that you test it with your software first.

If your needs are limited to large amounts of high-speed draft-quality type, the Microline 294 is worth considering. But disappointing NLQ type and limitations on color use effectively disqualify it from strong consideration as a business color printer. —Barbara Krasnoff

Fujitsu DL2400

Want it all? The Fujitsu DL2400, a 24-wire dot matrix printer, offers respectable speed, fine print quality for both text and graphics, successful emulation of an assortment of other printers, cartridge fonts, and a comprehensive front-panel switch-operated menu system for resetting defaults, which are then maintained in CMOS (complementary metal oxide semiconductor) memory. If that isn't enough, the DL2400 also prints in color.

The printer delivers near-letter-quality print at a rapid pace (56 characters per second in 10-characters-per-inch NLQ mode). The quality of this printhead (and other 24-pin heads) may soon squeeze daisy wheel printers out of much of their market. If you need better-quality printing, you'll have to get a laser.

The printer has a slick internal tractor-feed mechanism that is easily loaded on the inside bottom of the printer, and the tractor works bidirectionally (one of my personal hot buttons). Even though paper positioning was less than ideal, with the intake stack on the same level as the output stack, I didn't have any problems with the paper jamming or binding. Switching between continuous and single-sheet feeding is unusually simple.

For the times (however rare) when you need or want to produce color print or graphics, the Fujitsu DL2400 delivers very clear color and is software compatible with Epson JX-80 color codes, using a four-color ribbon to print in any of seven colors. Ribbons are fairly expensive (\$30 for a black multistrike ribbon and \$39.50 for color). But each ribbon is good for approximately 15 million characters (roughly 10,000 pages), making cost about three-

tenths to two-fifths of a cent per page. Inserting the ribbon is a bit tricky on the DL2400, and, to make matters worse, the procedure is different for black and colored ribbons.

The DL2400 has no DIP switches. All print-quality, character-style, character-spacing, line-spacing, language, emulation, interface, and protocol decisions are selectable from the front panel. One reason switching between emulation modes and quality modes is easy is that the DL2400 uses a 16-character liquid crystal display that leads you clearly through function modes and selections. Once you understand the menu process, you don't have to look anything up.

I was happily surprised to record speeds of 111 cps in 10-cpi draft mode, and 56 cps in NLQ mode. Printer speed performance is equaled by print quality, for both draft and NLQ modes. The Fujitsu DL2400 also uses font cartridges. It can access custom- and user-designed fonts, as well as use different fonts on the same page, depending on programming or software support.

In text mode the DL2400 acts like a Diablo 630, an Epson MX-80, or an IBM



FACT FILE



Fujitsu DL2400

Fujitsu America Inc.
3055 Orchard Dr.
San Jose, CA 95134
(408) 946-8777

List Price: \$1,395

Dimensions (HWD): 7.7×22.4×15.4 in.

Weight: 44 lbs.

Made in Japan

In Short: A fine dot matrix printer that features good quality type and graphics, reasonable speed, and ease of control and use.

CIRCLE 609 ON READER SERVICE CARD



PROBLEM: Handling your need for more megabytes, without spending megabucks on a new drive.

THE SOFTLOGIC SOLUTION: Cubit™

Now get up to twice the capacity from all your storage media.

You know what happens. The more you use your computer, the more information you create. And the faster you fill up your disk.

The 10MB drive that once seemed enormous is now jammed with important files. That 20MB that should have lasted years is crowded in a matter of months.

Of course you could keep buying bigger hard drives. Or you could get Cubit and get the maximum storage space from the drives you already have.

What is Cubit?

In brief, Cubit is an advanced software tool that automatically reduces the number of bytes required to store a file, then converts the file back to its original size when retrieved. Some programmers call this effect "data compression," others, "disk expansion." Either way, the result is the same.

Here's how it works. When Cubit compresses a file, it first compares each word to its massive English word dictionary. Words that match are reduced to a predetermined code of just one, two or three bytes each. It then saves the abbreviated version to disk. Decompression works just the opposite.

To accommodate other words and symbols, Cubit uses two more compression techniques. One assigns new, shorter codes to unusual words. Another compresses according to the frequency of character strings in non-text data. So no matter what kind of files you create, Cubit ensures maximum space savings.

Best of all, you'll be using the same fast, reliable data compression techniques used on mainframe computers for decades.

How much disk space will you save?

Because the vast majority of data created on PCs is standard ASCII text—letters, numbers and other English language symbols—we've optimized Cubit for word processing and database files. With these, you'll get a minimum of 50% expansion on up to a full 100% or more.

At the same time, you can expect a significant 30% to 50% improvement with other kinds of data. Including spreadsheet files, program code, graph and image files, even binary data.

And Cubit works just as well with floppies and tape cassettes as it does with hard disk drives.

Run Cubit where you want, when you want.

Maybe you'll want to use Cubit for all your files, or maybe just some. So Cubit lets you specify exactly which files to work on and which ones to leave alone.

In RAM resident mode, Cubit works quickly and invisibly, compressing and decompressing right from within any program you run. Or use Cubit's powerful file management mode. It supports wild-card and global file names, and addresses sub-directories up to thirty levels deep.

Save time and money, as well as disk space.

A compressed file is a smaller file. So with Cubit, back-ups

take less time, as well as less space. And communicating compressed files means significant savings on phone line charges.

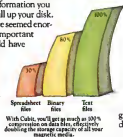
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DOT MATRIX—\$1,395–\$1,495

Proprinter. Graphics mode is even more adaptable, with the DL2400 able to print graphics like the IBM 5152 Graphics Printer, the Proprinter, and the whole Epson 80 and 85 family, including (and this is a big deal) the color codes of the Epson JX-80. The color bars printed by the DL2400 during our color test were very bright, without the horizontal white lines often found in color printing.

The Fujitsu DL2400 is a solid printer with a raft of useful features and great, if not record-breaking, performance. At \$1,395, the DL2400 is a very good value. If I could have only one printer, the DL2400 is the one I'd choose this year.

—Bruce Brown

Star NB-15

The Star NB-15 may not cause a stir among astronomers, but it should raise a few eyebrows among PC users. A sturdily constructed, 24-pin dot matrix printer, the NB-15 comes with serial and parallel interfaces, Epson compatibility, and two slots for optional font cartridges. That, an op-

tional sheet feeder, and its tested throughput of 120 characters per second make it more than capable of handling heavy printing jobs. Also, its easy front-panel control and 15-inch carriage should make it sparkle for the individual user who has to switch between word processing documents and spreadsheets.

Other features include both automatic and single-sheet paper feeding and a 16K-byte buffer, which is expandable to 32K with an optional buffer board. And if you're not dazzled by the default and cartridge fonts, you can always download draft or near-letter-quality characters of your own making.

Installing the NB-15 is a simple matter of connecting the cable to the appropriate port and ensuring that the DIP switches are properly configured. If you wish, you can also set the switches so that the printer comes with specific default settings, such as NLQ mode and condensed print. Instead of the usual clutter of front-panel buttons, the NB-15 uses touch-sensitive membrane technology for all but the form length dial. By lightly pressing one or two selections, you can set the type style, print mode, character pitch, and margins.

The NB-15 comes with the usual print enhancements such as boldface, emphasized, and proportional printing. Unlike some other printers, it allows you to mix the features with the NLQ type. Overall, the quality of the print is excellent, especially when using the proportional NLQ mode.

The cartridges (\$59.50 each), which slip into the easily accessible slots on the front panel, come with default and correspondence modes and the IBM high-order character set. You can select the fonts by using software or the front-panel buttons. Virtually no degradation in throughput takes place when you use the font cartridges. The PC Magazine Labs speed test showed a throughput of over 119 cps in draft pica mode and almost 60 cps for NLQ print. You pay for the speed with an inordinately loud 83 decibels, though.

Although the manual has enough illustrations, charts, and BASIC programs to fill the heavens, the lack of an index and the overall crammed type make much of the information as difficult to find as focusing on a specific star on a cruise.

Still, with its speed, type cartridges, and other features, the NB-15 is definitely a star in my book. The only other complaint I have is that it's priced relatively high at \$1,449. But if you find the NB-15 discounted, grab it—you'll be star struck by it, too.—Vincent Puglia

Genicom 3210

The sleek, modern, yet solid-looking Genicom 3210 is a workaholic dot matrix printer. Its credentials include a 100-percent duty cycle for around-the-clock printing and a printhead rated to print 300 million characters. But like human grinds, the Genicom 3210 doesn't have much else going for it, especially since it's priced at \$1,495.

While the 9-pin 3210 is factory rated at a swift 240 characters per second in data processing mode, its PC Magazine Labs test speed was 164 cps. Letter quality mode was 60 dots per second—slow for such an expensive printer. The PC Labs tests, however, don't take into account the printer's fast paper-feed mechanism (7-inches-per-second paper slew). While this feature helps speed up the printing of long



Star NB-15

Star Microelectronics
200 Park Ave., # 3510
New York, NY 10166
(800) 367-3119
(212) 986-6770

List Price: \$1,449; optional font cartridges, \$59.50

Dimensions (HWD): 4.7×22.8×15.1 in.
Weight: 32.6 lbs.

Made in Japan

In Short: An expensive but winning printer that offers flexibility in its use of font cartridges and delivers very good letter quality print.

CIRCLE 877 ON READER SERVICE CARD



Genicom 3210

Genicom Corp.
One Genicom Dr.
Waynesboro, VA 22980
(800) 437-7468
(703) 949-1000 (in Va.)

List Price: \$1,495

Dimensions (HWD): 6.3×25×16.1 in.
Weight: 37 lbs.

Made in U.S.A.

In Short: A \$1,495 dot matrix printer with shortcomings in terms of speed and print quality but a 100 percent duty cycle for long-term printing jobs.

CIRCLE 640 ON READER SERVICE CARD



PROBLEM: There's just no easy way to move from one software program to another.

THE SOFTLOGIC SOLUTION: Software Carousel

Now you can keep up to 10 programs loaded and ready to run.

Hard to believe, but some people are happy with just one kind of PC software. Well, this is not a product for them.

But if you're someone who depends on many packages, all the time—someone who'd use several programs at once if you could, well now you can. With Software Carousel.

Why call it "Software Carousel"?

In some ways, Software Carousel works like the slide projector you're used to. You load a handful of pictures, view one at a time, then quickly switch to another. A simple idea, with powerful possibilities for computing.

Here's how it works. When you start Software Carousel, just tell it how much memory you have, load your software and go to work.

Need to crunch numbers? Switch to your spreadsheet. Need your word processor? Don't bother saving your spreadsheet file. Just whip over to your document and do your work. Snap back to your spreadsheet, and it's just like you left it.

With up to ten different programs at your fingertips, you'll have instant access to your database, communications, spelling checker, spreadsheet, word processor, RAM resident utilities, languages, anything you like.

Reach deep into expanded memory.

This could be the best reason ever for owning an expanded memory card, like the Intel Above Board, AST RAMPage, or any

card compatible with the L1/M Extended Memory Standard.

Software Carousel puts programs into this "high-end" memory for temporary storage when they're not in use. And

switches them back out when you want them. It's fast, efficient, and easy.

If you want, Software Carousel will even use your hard drive for swapping. Just allocate a portion for storage, and go to work.

Sidekick, Superkey and Ready. All at the same time.

You know what happens if you try loading two or more RAM resi-

dent utilities at once. You get crashed keyboards, frozen screens, all kinds of interference between programs fighting for control.

With Software Carousel, you can have as many accessories and utilities on-tap as you want. Just load different ones in different Carousel partitions. Since they can't see each other, they can't fight.

The easy way to maximize PC power.

With all this power, you might think Software Carousel is complicated and difficult to use. Not so. Set it up once, and it will remember forever. Better still,

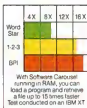
Carousel will look for the programs you use most often, and optimize them for the quickest access.

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As a special holiday bonus, you can get another SoftLogic Solutions product free when you buy Software Carousel and Disk Optimizer—the software that speeds up your disk by cleaning up your files.

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Enclose proof of purchase for Software Carousel and Disk Optimizer, both registration cards, this coupon, and \$5.00 (check or money order) for shipping and handling (UPS). Offer expires Dec. 31, 1986. Allow up to four weeks for delivery.

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*plus \$5.00 shipping and handling



If your workload demands constant printing, the Genicom 3210 may pay off in endurance what it lacks in sophistication.

documents, beware: paper tends to feed back into the tractor. The manual documents this problem, suggesting you use paper guides and baskets to avoid it.

The Genicom 3210 emulates either the IBM 5152 Graphics Printer or the Okidata Microline 82. The standard font is Courier Letter Quality, but other plug-in fonts, such as Gothic, OCR-A, and OCR-B, are available as options. Both the draft and letter quality print look mediocre: washed out in draft mode and squished together in letter quality mode. The printer creates super- and subscripts in both modes by advancing or reversing the paper feed by half a line and printing text in normal size rather than in condensed type.

The printer's noise level is acceptable, unless you're printing graphics. During the PC Labs test for graphics compatibility, the printer emitted a loud squeal as though it had gotten its cable tail caught in a trap.

Replacing a ribbon on the 3210 is no fun at all. First, you position the ribbon guide over the tip of the printhead. Then, you must loop the ribbon around the ribbon guide rollers and be sure to check the placement of the half twist in the ribbon. Although the generally clear and helpful manual does not describe this process adequately, you'll find good directions in the ribbon box.

With the ribbon in place, the 3210 is relatively easy to operate. The front panel has five pressure-sensitive switches and a ten-position rotary switch that let you switch fonts, modes, characters per inch,

and forms depth. A bank of 32 DIP switches accommodates the standard serial and parallel interfaces. Unfortunately, to reach the switches, you must remove the ribbon.

My overall reaction to the Genicom 3210 was disappointment. At its \$1,495 list price, I could never recommend it as a general-purpose printer, and yet its price reflects its ability to work all day, every day. All in all, the Genicom 3210 doesn't have enough going for it for my purposes, but if your workload demands constant printing, you may find the printer pays off in endurance what it lacks in sophistication. —Joe Desposito

ALPS P2100

The well-designed, built-to-last ALPS P2100 is a powerful printer. Its 18-pin printhead produces good-quality type at a good clip. It emulates both Epson and IBM dot matrix printers and can access optional plug-in cartridge-loaded fonts.

But even with all these great features going for it, the 18-pin ALPS P2100 is in danger of being overshadowed by its "lesser" sibling, the 9-pin P2000, which is also reviewed in this issue. The general rule is that the greater the number of pins in a dot matrix printhead the better the print quality. Unfortunately for the P2100, everyone I showed print samples to thought the P2000 produced better type.

The P2100 is the faster of the two; in draft mode it cooks along at 173 characters per second while the P2000's rate is 138 cps. The difference of 35 cps can be an important one on long data runs handling mailing labels, for example, when every extra label printed per minute or per hour is significant.

If the only differences between the P2000 and the P2100 were speed and quality, then you could make a choice based on your needs. The choice is not so clear, however, because the P2100 costs \$600 more than the P2000—a lot to pay for lower type quality and just a half-line per second more in speed.

Both printers offer a dual-identity push-pull tractor-feed, an attractive feature. The P2100 also has a comprehensive control panel for selecting such print characteristics as line spacing, characters per inch, type style, and mode. It has a reverse half-



FACT FILE



ALPS P2100

ALPS Electric (USA) Inc.

3553 N. First St.

San Jose, CA 95134

(408) 946-6000

List Price: \$1,595

Dimensions (HWD): 5.5×24.4×16.5 in.

Weight: 41.9 lbs.

Made in Japan

In Short: A fast dot matrix printer that shines by itself but pales a bit in comparison with the ALPS P2000.

CIRCLE 807 ON READER SERVICE CARD

line-feed button. Other buttons on the panel control buffer copying and buffer clearing. The standard 4K-byte buffer can be expanded in 64K increments to 260K for greater flexibility with copying, spooling, and programming fonts.

The P2100's manual, shared with the P2000, is excellent. The documentation covers all you want to know and then some without too much technical jargon.

The P2100 is graphics compatible with the IBM 5152 Graphics Printer and Proprietary and with the Epson MX-80, FX-80, and FX-85 printers. Both ALPS models are text compatible with the Epson MX-80 and the IBM Proprietary. The P2100 also prints the high- and low-order IBM PC character sets.

The ALPS P2100 is a solid printer and worth considering if speed is your highest priority. At \$1,595, it competes with some strong higher-end dot matrix printers, some of which are significantly faster. The P2100's price/performance ratio may still be competitive, but unless speed is all that matters, I'd give serious thought to the ALPS P2000 before buying the P2100.

—Bruce Brown



PROBLEM: The more experience your hard disk has, the harder it has to work.

THE SOFTLOGIC SOLUTION: Disk Optimizer™

Your hard disk will run faster when it's not chasing around after files.

Remember the old days when your hard drive was new? Remember that smooth, fast, slick performance? Those quick retrievals, rapid saves, lightning-like database sorts?

Well ever since, DOS has been doing its best to slow your hard drive down. Not by slowing down the motor, but by breaking your files up into pieces. Storing different chunks in different places. Data files, programs, overlays and batches that started out in one seamless piece are now scattered all over.

Loading is slower.

Sorting is slower.

Retrieving, backing-up. Everything takes longer because your disk has to work harder.

Problem is, it's something that happens so gradually you may not notice the difference. At least, not until you see the dramatic improvement after using Disk Optimizer.

File fragmentation—It's a problem you can see.

Watch your hard drive the next time it reads or writes a file. Each "blip" of the LED means the drive-head is moving to another place on the disk—either to pick up or lay down another chunk of data.

And the truth is, head movement takes time. Far more time than actual reading and writing. What's worse, all this head movement causes extra wear and tear that can shorten the life of your drive.

Disk Optimizer—Times up your disk by cleaning up your files.

Disk Optimizer works by finding all the scattered pieces of your files and putting them

back together where they belong. Next time your drive reads it, there's just one place to look.

And the results are often dramatic. Reading and writing times may be cut by as much as two thirds. Database sorts that used to take hundreds of head moves now proceed quickly and efficiently. And since head movement is now at an absolute minimum, your disk drive will lead a longer, more productive life.

Analyze, scrutinize, optimize.

Before you optimize, you'll probably want to analyze. So Disk Optimizer shows you, in percentages, how much fragmentation has taken place—on the

entire disk, in individual directories, or for groups of files you specify using global or wildcard names.

Plus, there's built-in data security that lets you assign passwords to as many files or file groups as you want.

And the File Peeker gives you an inside look at the structure of files. It's a great way for non-programmers to learn more about computers, and a powerful tool for professionals who want to analyze the contents of their disks.

Get your hard drive back in shape—at a special low price.

When you think about it, it's simple. The longer you

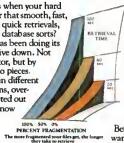
own your hard drive, the more you come to depend on it. But the longer you wait to get Disk Optimizer, the less performance you'll have.

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6 Disk Optimizer \$4995*



Epson LQ-2500

The many-featured, wide-carriaged Epson LQ-2500 has a clean design incorporating a built-in push-feed tractor. A break in tradition with Epson's pull feed, the tractor makes loading continuous feed paper the easiest yet. A simple paper rest is an ingenious way to keep the rear printer cables from snarling up the paper feed.

On the LQ-2500's state-of-the-art front control panel, two buttons select letter quality or draft mode, but that's only the tip of the iceberg. In addition to the more traditional functions, the buttons on the panel form the backbone of SelectType, Epson's replacement for the DIP switch. SelectType's strength is its four predefined macros. You select not one print feature at a time but a slew of them. The printer comes with four macros providing automatic print setups for draft, letter-quality, condensed, wide-carriage, and graphics printing, all of which you can replace with user-defined macros. A large LCD window indicates the current SelectType setting.

The LQ-2500 has five built-in fonts: roman, sans serif, Courier, Prestige, and

The LQ-2500's fonts will wow you; all are handsome, elegant, tight, and absolutely letter quality.

Script. They'll wow you; all are handsome, elegant, tight, and absolutely letter quality.

Twenty-four pins can move mighty quickly. Our tests showed a respectable 104 characters per second in default mode and 57 cps in letter quality mode. However, like most 24-pin printers, the LQ-2500 suffers from the shrieks at high speeds. The noise is very audible and is a much faster, higher-pitched sound than that of the 9-pin Epsoms.

The printer command menu uses Epson's Master Select EScapE codes, which allow you to select varied combinations of font, pitch, and character type with a single command. Print size, character width (condensed and double width), and print enhancements (italics and emphasized) are also easily selected from this menu.

Epson's reasonably priced Color Option Kit (\$99.95) includes a color ribbon and a pillbox-size stepper motor. When you insert the motor, the transport mechanism on the ribbon carrier is activated and the four-color printer ribbon rides up and down to create seven vibrant colors that could dazzle a rainbow.

Unlike most recent Epson printers, the LQ-2500 does not include a selectable IBM emulation mode. Instead, Epson has incorporated the IBM graphics characters as an extension of the Epson EScapE/P codes (Epson Standard Code for Printers). Now it is possible to obtain italics (the traditional Epson offering) or IBM graphics characters depending on the specified mode. The printer is IBM graphics compatible as long as you select the graphics character set.

The Epson manual is an education in printing. Informative, attractive, and well-organized, it should set the standard for other manuals.

I hope Epson continues to support this dandy of a printer with goodies like scientific and mathematical fonts. The LQ-2500 printer is a class act, the haute couture of printerdom. —Robin Raskin

IBM Quietwriter Model 2

Gorgeous print quality, quiet operation, good speed, and selectable fonts don't come with laser printers only. The IBM Quietwriter Model 2 delivers all these and more. While its measured speed on the PC Magazine Labs test, 26 to 28 characters per second, is not terribly fast, the aptly named Quietwriter seems faster.

The Quietwriter Model 2, a thermal-transfer printer, can create graphics (the Model 1 can handle only text). It has three graphics density modes: 120 by 76, 120 by 120, and 240 by 240 dots per inch, and it passed the PC Magazine Labs graphics compatibility tests for the IBM 5152



FACT FILE



Epson LQ-2500

Epson America Inc.
2780 Lomita Blvd.
Torrance, CA 90505
(800) 421-5426
(213) 539-9140 (in Calif.)

List Price: \$1,595; color option, \$99.95
Dimensions (HWD): 5.6 x 23.25 x 14.75 in.
Weight: 26.4 lbs.
Made in Japan

In Short: The haute couture of the Epson dot matrix line of printers, with its high-tech menu-selectable control panel, 24-pin font creations, and precision color option.

CIRCLE 678 ON READER SERVICE CARD



FACT FILE



IBM Quietwriter Model 2

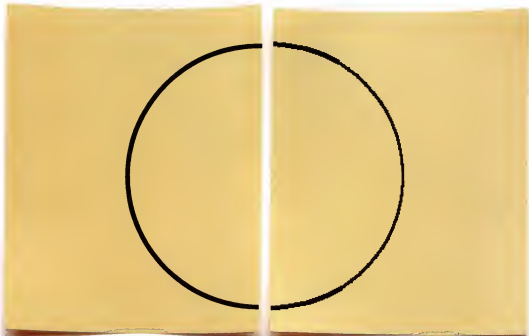
IBM Corp.

Contact your local authorized IBM dealer.
List Price: \$1,595 plus \$75 for tractor-feeder and \$350 for sheet-feeder
Dimensions (HWD): 8.5 x 21.3 x 14.4 in.
Weight: 22 lbs.
Made in U.S.A.

In Short: The IBM Quietwriter Model 2 delivers gorgeous print quality, quiet operation, and selectable fonts, but the ribbon cartridges raise the per-page cost considerably.

CIRCLE 684 ON READER SERVICE CARD

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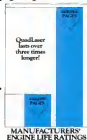
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There is no question we have met our every objective by developing and manufacturing the **BREAKTHRU 286** card. This is the best designed and most functional speed up card available today. We guarantee it.

HERE IS WHAT MAKES IT SO SPECIAL.

First, it installs so easily. It is a half slot card, only five inches in length. You don't even have to give up a full slot. What's more, unlike competing products it works in the Compaq and most clones. The instructions are so simple we considered showing a picture of a child putting it in. Easy diagrams show how you just place the card in an open slot, remove the original processor and connect a single cable. There is no software required. From that moment you are running faster than an AT.

Second, it is advanced. The **BREAKTHRU 286** replaces the CPU of the PC or XT with an 80286 microprocessor that

is faster than the one found in the AT. A 16K cache memory provides zero-wait-access to the most recently used code and data. In benchmark tests the card accelerated software programs—both custom and off-the-shelf anywhere from 200% to as much as 700%. Wow!

Third, you have full compatibility. All existing system RAM, hardware, and peripheral cards can be used without software modification. It operates with LAN and mainframe communication products and conforms to the Lotus/Intel/Microsoft Expanded Memory Specification (EMS). Software compatibility is virtually universal.

Fourth, it is the best there is. There are several other boards on the market. Some are priced about the same as the **BREAKTHRU 286** and some are cheaper. We at PCSG have compared them all, but there simply was no comparison. What we discovered is that many cards being sold offer only a marginal speed up in spite of their claims. We found some to be merely versions of the obsolete 8088 or 8086, and others to be just poorly engineered. The 8MHz **BREAKTHRU 286** is unequivocally the best executed and most completely reliable speedup board manufactured today.

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Graphics Printer and the IBM Proprinter.

The Quietwriter's three methods of paper feeding—standard manual single-sheet feed, optional single-bin automatic sheet-feed, and tractor-feed—all work smoothly, using the printer's paper auto-load feature. My favorite is the automatic sheet-feeder. Finished pages are pushed up into a holding bin and ready for perusal.

Two slots just inside the front cover accept font cartridges, which are easily software selectable. You can have more than one font in the same document or even in the same line if your word processing software supports it.

If you can ever consider printer installation fun, it is with the Quietwriter. This printer has enough unique features to keep the process interesting, but at the same time the user's manual is so simple and precise that most people will find installing the Quietwriter an easy, first-time-right process. The two-color manual is without equal in its clarity and completeness, wisely breaking down all the procedures into small steps.

My only concern about using the Quietwriter is the expense of the ribbon cartridges. IBM rates them as lasting 160,000 characters each, which I estimate to be between 100 and 110 double-spaced pages—that is not a lot. Replacement cartridges cost \$12 each; \$10.50 each in quantities of 12. The cost of the cartridge may be a small price to pay for fine quality type and quiet operation, but it works out to cost between 10 and 12 cents per page. One reassuring note is that when the Quietwriter Model 1 first came on the market, the ink from the ribbon cartridges was erasable; IBM quickly corrected that problem, which I'm happy to say doesn't show up in the Model 2.

The Quietwriter's print quality is great, comparable to that of a laser printer. Although the Quietwriter is slower and more limited in fonts and graphics ability than a laser printer, it's less expensive. It prints envelopes and accepts wide-format and continuous-form paper, which standard lasers don't. Since it works on the thermal-transfer principle, it won't print carbons or multipart forms as will daisy wheels and dot matrix machines, but it prints terrific graphics. And it operates quietly and unobtrusively, unlike most daisy wheels.

Perhaps the Quietwriter Model 2 should be on your hardware requisition list this year (don't forget to put in your order for some additional cartridges too).—Bruce Brown

Nissho NP-910

The Nissho NP-910 is a wide carriage, impact dot matrix printer that looks like it's intended for heavy-duty fast printing in an office setting. It's physically big and sturdy, with large parts and a top front dust cover that has a sturdy double magnet closure found commonly on cabinet doors—push once to close, again to release. Rounded corners and three nifty, wide, curved paper guides on the tractor feed make the NP-910 look attractive with modern office decor.

An acceptable printer for office use, the NP-910 offers adequate print quality and clear graphics, and it doesn't make too much noise. But I think that a machine designed for much use should be faster. And in fact, Nissho claims that the NP-910 is

faster—it claimed speed of 350 characters per second in draft mode, which is very respectable for a dot matrix printer. I expected test results to reveal an actual cps speed of something over 200, possibly even 250. But the printer achieved a rating of only 150 cps, with consistent scores on repeated runs.

On the other hand, changing fonts is a quick procedure, while print modes and other features are easy to use. In addition to the usual front panel switches, a second panel behind a pull-down cover includes selectors for printing direction, lines per inch, italics, boldface, font style and size, and form length. You can control all of these features with the software, but it's nice to have switches and toggles right up front. The exception is the NP-910's DIP switches, which you access by removing the printer's back panel. Luckily, the only reason you change DIP switch settings is to choose between IBM and Epson modes; so if you don't do that too often, you'll have little aggravation.

The NP-910 comes very close to being PC compatible, missing full high-order compatibility by a mere five characters. But you should have no trouble making your software work with the NP-910. Text printing is both Epson MX80 and IBM Proprinter compatible. The NP-910 passed the graphics comparison tests for the Epson MX80, JX80, LX80, FX80, and FX85 and the IBM 5152 Graphics Printer and Proprinter.

After sorting through all the stuff in the box—tractor feed and hood, interface card, two ribbons, paper guide, power cord, and manuals—and reading directions carefully, you'll find that setup and installation have taken you about an hour. The documentation, a user manual and a programming manual, is technically correct and reasonably complete, even though both manuals are marked "tentative" and dated September 27, 1985. You'll notice errors in grammar and spelling throughout, but not enough to cause significant problems. To save yourself some trouble, you should follow the manual when setting up your printer.

In sum, the NP-910 is a bruiser designed for business use. But the only thing I could get excited about was its ease of access to printer feature selection devices.



Nissho NP-910
Nissho Information Systems
10855 Business Center Dr., #100
Cypress, CA 90630
(800) 952-1919 (outside Calif.)
(800) 443-9998 (in Calif.)
(714) 952-8700

List Price: \$1,595
Dimensions (HWD): 5.2×23.6×15.6 in.
Weight: 33 lbs.
Made in Japan

In Short: The Nissho NP-910 is a sturdy wide-carriage printer with an attractive Courier 10 letter quality mode, close PC compatibility, ease of use, and good emulation of the Epson 80s and 85 and the IBM 5152 Graphics Printer and 5152 Proprinter.

CIRCLE 600 ON READER SERVICE CARD



Speed and print quality are appropriate for the price bracket, but I wish it were just a bit faster for the money. —Bruce Brown

AT&T 477

The AT&T 477 color printer is a weighty entry in the color printer race, both figuratively and literally. Don't lift it if you have a back problem! Once you get it in place, though, you shouldn't have to remove it—it's that good.

A dot matrix printer that prints up to seven colors using a four-color ribbon and a 24-wire printhead, the AT&T 477 is exceptionally well planned physically. The covers that protect the printhead and the platen are sturdy and well placed (although the machine does have a tendency to "re-feed" itself, unless you're careful to guide the paper). All the important switches, including the on/off switch, are located on the front of the machine, and levers that you use to manipulate the platen are located on the outside of the machine rather than under the cover. AT&T even supplies a pair of plastic gloves with each new ribbon, even though it installs smoothly and with almost no mess.

The printer's small 16-character LCD screen allows the printer literally to "talk" to you. Taking the place of all those little red LED lights that ornament most printers, it tells you when the printer is on- or off-line and when you need to load paper. You also use it to program the printer for its various modes. The three touch-sensitive membrane switches next to the LCD screen each have three purposes. In their first incarnation, switch number one acts as the on-line/off-line button, switch number two as the form-feed, and switch number three as the line-feed. In combination with the shift, they act, respectively, as the Setup key (which puts the printer into program mode), the Load key (which causes the platen to move forward, "automatically" loading paper), and a microline-feed.

Finally, if you hit the Shift key together with key one, you put the printer into setup mode, and the same three switches become programming devices. In this mode, you can program the 477 for a variety of type sizes, colors, or other options. The Setup menu offers several options: Emulate, which enables it to emulate itself, a



FACT FILE



AT&T 477
AT&T Information Systems
P.O. Box 45038
Jacksonville, FL 32232-9974
(800) 247-1212
List Price: \$1,695

Dimensions (HWD): 6.4×22.4×15.3 in.
Weight: 40 lbs.

Made in Japan

In Short: An excellent color printer featuring a 16-character LCD screen that helps you program the machine for an impressive variety of features.

CIRCLE 648 ON READER SERVICE CARD

Qume Sprint 11, the IBM color and graphics printers, and two other AT&T printers, the 455 and the 470; Style, which allows you to program it for specific type qualities, fonts, character sets, type attributes, characters per inch, language sets, colors, page lengths, and lines per inch; Intrifce, which adjusts to parallel or serial interfaces; List, which prints out the programming the 477 is presently following; Test, which has both a self-test and a hex dump mode; and Reset. You choose each option (or Font) with switch two and access subcategories within these options (different point sizes, for example) with switch three.

Print quality equals that of any other dot matrix machine and would pass most contests with flying colors. Besides draft and letter quality types, the 477 also has a correspondence quality mode, which is supposed to be more legible than draft mode but faster than letter quality mode. I actually found this mode less attractive than the draft; it's also unnecessary since the letter quality mode tested at a steady clip of 75 characters per second, which beats out many other printers. At a tested draft mode

rate of 144 cps, the 477 could probably put out a memo before you had time to pour your coffee.

The colors the printer produces are clear and well defined. You can also equip the 477 with special ribbons to create transparencies for overhead projection.

With its LCD command screen, the AT&T 477 is exceptionally easy to use and program. Plus, its clear type and color printing mean that it's ideal for making the most of business graphics software. In this case, AT&T is the right choice after all.

—Barbara Krasnoff

NEC Pinwriter P5XL

According to NEC, the Pinwriter P5XL is one of its hottest new printers. That's not surprising: although not inexpensive, the machine has enough assets to satisfy most business needs.

The Pinwriter P5XL is a dot matrix printer that takes three types of ribbon: black fabric, color, and—one of its primary selling points—a black multistrike film ribbon that produces a sharper character quality. You operate the P5XL using five touch-sensitive membrane switches: select, which operates as an on/off line toggle; feed, which works as both a line- and form-feed; mode, which toggles between draft and near-letter-quality output; font, which switches among various type sizes; and quiet. The quiet switch is an intriguing addition: it lightens the impact of (but slows down) the printhead, decreasing the noise level of the printer by approximately 5 decibels.

A small LCD panel next to the font switch indicates the P5XL's current state (CO, for example, indicates that the cover is not in place) and the particular font that the machine is using. By font, NEC really means print size; the default font for the Pinwriter P5XL is gothic, although it does switch to a Courier font for 10- and 12-point NLQ type. However, below the switches are two cartridge slots that accept both optional font and RAM cartridges (the latter can extend the printer's input buffer up to 40K bytes).

Three sets of DIP switches at the back of the printer make it relatively simple to change such defaults as print mode, line

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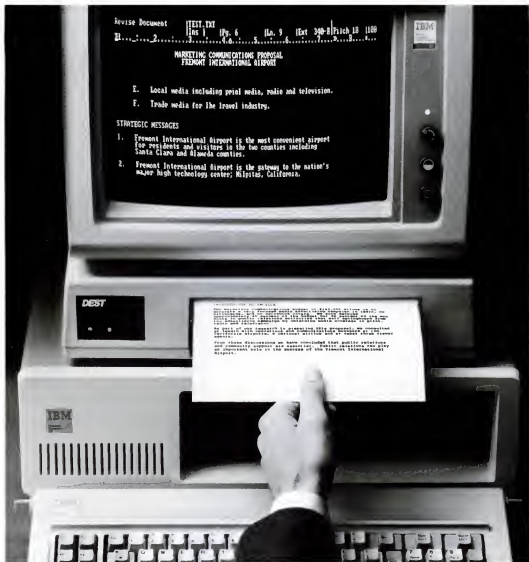
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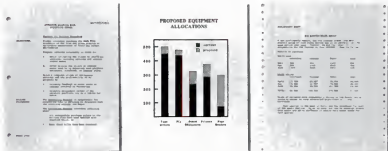
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FACT FILE

**NEC Pinwriter P5XL**

NEC Information Systems Inc.
1414 Massachusetts Ave.
Boxborough, MA 01719
(617) 264-8000

List Price: \$1,695

Dimensions (HWD): 6.1×22.8×14.7 in.

Weight: 35.2 lbs.

Made in Japan

In Short: A well-planned, easily operated business printer that offers a variety of functions, including high-speed printing, a quiet mode, plus a color ribbon and a black multistrike film ribbon.

CIRCLE 601 ON READER SERVICE CARD

and more typewriterlike font than the default mode.

The printer also has a high-speed mode that chugs along in a somewhat condensed and sloppy typeface at 123 characters per second. On the other hand, if you're tempted by the Pinwriter P5XL's quiet mode, be warned: since the printhead makes extra passes to compensate for the lighter impact, the machine slows down by more than 50 percent.

But although the quiet mode works better in theory than in reality, that shouldn't overshadow the Pinwriter P5XL's generally high standard of print quality, speed, and function. —**Barbara Krasnoff**

Toshiba P351C

If my review of Toshiba's contribution to this year's survey of printers doesn't sound quite as enthusiastic as those in the past, it's only because there just wasn't much to improve upon in last year's P351. Like the P351, the new P351C is a 24-pin dot matrix printer that is able to achieve close to daisy wheel quality. The biggest news this year is the "C" suffix, which stands for "color."

Even if you don't care about color, the P351C is still a very good printer. Perhaps its best feature is its flexibility in selecting fonts. At any time, you have access to eight different fonts: four built-in fonts (a high-speed draft and letter-quality Courier, Proportional Courier, and Prestige Elite), two from optional font cartridges, and two more downloadable from software.

The improvements in the P351C over last year's P351 are mostly in IBM compatibility. While the native mode of the P351C emulates the Qume Sprint 11, you can also select IBM-control-sequence emulation with a DIP switch in the back. This DIP switch was on the P351, but it did not provide a complete emulation. The P351C now offers control-sequence compatibility with the IBM 5152 Graphics Printer, including all the graphics modes. The second improvement in IBM compatibility is that the P351C now prints the entire IBM high-order character set when you select a built-in font. However, the typeface used for the line- and box-drawing characters (ASCII codes B0h through DFh) is dotty

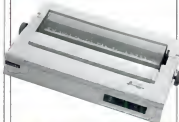
and not well formed. These characters look distinctly inferior to the rest of the character set.

The Toshiba P351C has a four-band ribbon (black, cyan, magenta, yellow) for color printing. Toshiba has chosen to implement the IBM Color Printer control sequences for selecting among these bands. Although the IBM Color Printer was one of IBM's bigger printer bombs, at least it has the advantage of having wide support from software that can print in color. These same control sequences are available in both the Toshiba/Qume and the IBM control sequence set.

However, the P351C is not entirely compatible with the IBM Color Printer control sequences. It's really only compatible with the IBM 5152 Graphics Printer sequences, to which some Color Printer codes have been added. Fortunately, this implementation is complete enough to print medium-resolution color-graphics screen dumps after loading the PC-DOS 3.0 (and later) Graphics program. (To complicate the compatibility issue even



FACT FILE

**Toshiba P351C**

Toshiba America Inc.
Information Systems Division
2441 Michelle Dr.
Tustin, CA 92680
(800) 457-7777
(714) 730-5000

List Price: \$1,749

Dimensions (HWD): 5.9×22×15 in.

Weight: 33 lbs.

Made in Japan

In Short: A very good printer that adds disappointing color but improved IBM compatibility to last year's model.

CIRCLE 600 ON READER SERVICE CARD

more, another DIP switch in the back of the P351C purportedly selects between compatibility with the IBM 5152 Graphics Printer and the IBM Color Printer. However, this DIP switch really selects between the two different variable line spacing amounts used in the Graphics and Color Printers.)

As for color, the P351C print looks OK when compared with that of other color dot matrix printers, but it's nothing special. The cyan, magenta, and yellow colors on the ribbon have to be overprinted in multiple passes to get red, green, and blue, and the results look splotchy over large areas.


Like the IBM Color Printer, the Toshiba P351C can be fitted with an all-black ribbon. The P351C comes with only a single-sheet guide, so you'll probably want to add one of the options—a unidirectional tractor (\$99), a bidirectional tractor (\$199), or a sheet-feeder (\$349 for a single-bin, \$199 more for double-bin).

The P351C is still an excellent high-quality dot matrix printer, but Toshiba now faces some competition from NEC and Epson, both of which have recently released 24-pin dot matrix printers that cost under \$1,000. A good implementation of color certainly would have set the P351C apart. Next year I want to see a color printer from Toshiba that will be nothing short of spectacular. —Charles Petzold

Nissho NP-2410

A good example of a modern, high-performance 24-pin dot matrix printer is the Nissho NP-2410. A large printer with convenient features and rugged components, the NP-2410 is powerful. Its speed is very good. It has a wide carriage, several resident character fonts, and terrific print quality. In fact, more than one person I showed print samples to thought at first glance that a laser printer had printed the Nissho's Century proportional font.

The NP-2410 is the 24-pin version of the Nissho NP-910, a 9-pin dot matrix printer. The greatest difference between the two is the print quality. Both printers have the same resident fonts and other capabilities. The NP-910's print quality is very good, but the NP-2410's is beautiful. In addition, the NP-2410, factory rated at 300 characters per second in draft pica



PC FACT FILE

Nissho NP-2410
Nissho Information Systems
10855 Business Center Dr., #100
Cypress, CA 90630
(800) 952-1919
(714) 952-8700
List Price: \$1,845 with parallel interface,
plus \$195 with tractor-feed mechanism
Dimensions (HWD): 6.2x23.6x17.1 in.
Weight: 33 lbs.
Made in Japan

In Short: A strong contender in the higher-end dot matrix printer market, offering good speed, excellent print quality, and selectable fonts.

CIRCLE #11 ON READER SERVICE CARD

mode, turned in 164 cps on the PC Magazine Labs test. The NP-910 is rated at 350 cps but tests out at only 150. So the NP-2410 gives you better-quality type and faster operation.

The NP-2410 is text compatible with the Epson MX-80 and the IBM Proprinter and is graphics compatible with the whole range of Epson MX, FX, LQ, IBM 5152 Graphics Printer, and the IBM Proprinter. It includes four built-in type fonts, and it will take ROM font cartridges as well. You can select the fonts, which include Courier 10, Letter Gothic 12, and proportional-space Century in addition to draft fonts of 10, 12, 15, and 18 characters per inch, either with the front-panel switches or through programming. In addition to selecting fonts and print sizes, you can also control line height, italics, boldface, form length, and bidirectional or unidirectional printing from the printer's front panel.

Setting up the NP-2410 takes a while; it includes installing the printer interface card, the ribbon, and the cables, as well as the optional \$195 tractor-feed mechanism if you purchase it, which I recommend do-

ing. The manual covers the installation process well. The only irritating part of the setup process is having to remove the back-panel interface card to check or reset the printer DIP switches to select IBM or Epson mode. Fortunately, you probably won't need to change the switches after the initial installation.

The Nissho NP-2410 is not inexpensive. The printer with a parallel interface card costs \$1,845, and the bidirectional continuous form tractor-feed mechanism is an additional \$195. The price of the NP-910, on the other hand, is \$1,595, including both the interface and the tractor-feed mechanism. Possibly Nissho wanted to keep the NP-2410's list price under \$2,000 and therefore priced the tractor-feed separately. Comparably equipped, the NP-2410 costs \$445 more than the NP-910, but that \$445 may be worth it if you intend to get along with only one printer.

The only remaining question bearing on purchase of the machine is whether service and support for the Nissho line are available in your area. If they are, the rugged Nissho NP-2410, offering productive speed and fine quality print in several fonts, may be just the machine for a single-printer office. —Bruce Brown

Seikosha BP-5420AI

Year by year, the average printer from the average manufacturer gets a little bit better, but rarely does one make leaps of sophistication and performance as great as those found in the new Seikosha BP-5420AI. This high-speed printer, well suited for data processing, is as rugged as it is stylishly handsome. And its excellent acoustic insulation makes it quieter than almost every comparable dot matrix printer.

Setting up the printer is simple, with one exception: to learn how to install or remove the ribbon cartridge, you must read the manual, which tells you to move the printhead adjustment lever all the way forward, snap in the cartridge, and then move the lever back to its normal position. If you forget to move the lever when removing the cartridge, you will probably break something.

Installing paper forms is also easy. You can feed paper from the back or the bottom. Because of its sturdy tractor-feed

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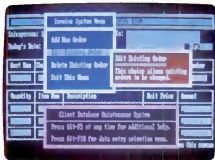
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Selkusha BP-5420AI
Hattori Seiko Computer Peripherals
1111 MacArthur Blvd.
Mahwah, NJ 07430
(800) 422-7768
(201) 529-4655 (in N.J.)
List Price: \$1,849
Dimensions (HWD): 7.6×23.4×15.9 in.
Weight: 59.5 lbs.
Made in Japan
In Short: A dot matrix printer that offers relatively poor font and print quality but prints fast and quietly.

CIRCLE 844 ON READER SERVICE CARD

mechanism, the BP-5420AI is unlikely to jam despite the high speed of its page feeds. The friction rollers also handle single sheets without fuss.

The BP-5420AI's relatively quiet 70 decibels and tested speed of 216 characters per second in draft mode and 133 cps in near-letter-quality mode make it a good printer for heavy-duty data processing applications. But the printer's unusual 8-pin printhead, which helps it to speed along so fast, sacrifices print quality. The BP-5420AI's fonts are uninteresting at best, ugly at worst. In fact, NLQ mode on the BP-5420AI looks like double-strike print from the Epson FX-80 series, and draft mode looks like a photocopy of a photocopy of output from the Epson.

Print enhancements include pica, elite, condensed, and proportional pitches, which can be printed in draft, draft italic, NLQ, and italic NLQ modes. Boldface, shadow print, underlining, subscripts, and superscripts are available. Still, none of these enhancements can yield quality sufficient for business correspondence.

Accessing these features, though, is only a matter of pressing a button. The

front panel has five convenient buttons (on/off line, line feed, form feed, top of form set, and reset to power-on status) and two dials (offering pitch and quality selections and form-length choices).

DIP switches on the printer's outside rear panel allow you to choose serial or parallel interface. In the parallel printer mode, the BP-5420AI may be set for standard or IBM modes. One more goody: this printer has an 18K-byte buffer, and so most print jobs don't hold up the computer for long. Many manufacturers charge extra for this option, and most don't offer as much memory.

Although the BP-5420AI's print quality and fonts could stand improvement, you'll want to consider this printer if you're looking for speed without the usual trade-off in ear-shattering noise.

—Phil Wiswell

JDL-750e

Calling all power printer users! It's finally here, a 24-pin dot matrix printer that's laden with features, emulates an extended family of Epson and IBM printers (not to mention the Diablo 630), prints in color, and has enough LEDs on the front panel to wow even the most ardent stereophile on your block. If that's not enough, it's also fast and it produces more-than-adequate letter-quality printing.

It's during installation and setup that you realize that this is no beginner's machine. Right off, you have to tear the machine open to see where the optional interface and memory cards reside and to learn how to set the power-on default DIP switch settings. Nothing about the process is difficult, but few novice users will feel comfortable tackling the inside of this impressive printer.

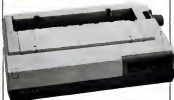
Print quality and speed in both draft and letter-quality modes are very good. The 180-character-per-second draft mode factory estimate is typically higher than the 102 cps actually measured. Letter quality, rated by the company at 100 cps, turns out to be 74 cps, and it produces a very nice Letter Gothic font. I like the appearance of both the draft and letter quality print modes and would probably use draft mode for most of my work. The printer handles both wide (15.1-inch) and standard-size paper.

The list of features is quite extensive and impressive. You control some of these features through switches on the front panel that run menu programs; other features are programmable. The menus, which are very easy to use, allow you to control paper movement, fonts, print modes, page and printing features, and diagnostics. Menus also give you access to two unique features: four fonts (Courier 10, Letter Gothic 12, Gothic 17, and PC10) that are resident in memory at all times; and, depending on the amount of memory in the printer, as many as four user-defined fonts that can be resident simultaneously.

The menus also let you select emulation of the Diablo 630; the Epson MX, FX, and JX printer series; the IBM Model 5182 Color Printer; the IBM 5152 Graphics Printer; and the IBM Proprinter. The escape codes used for programming special features depend on which of these you've chosen. While programming for special features, for the most part, worked fine, I did find one error in the manual regarding the ASCII code for underlining when programming the printer with Epson codes. Programmable printing features include

PC
MAGAZINE

FACT FILE



JDL-750
JDL Inc.
2801 Townsgate Rd., #104
Westlake Village, CA 91361
(805) 495-3451
List Price: \$1,850
Dimensions (HWD): 5.5×24.5×15 in.
Weight: 35 lbs.
Made in Japan
In Short: The JDL 750e is a high-powered, heavy-duty printer. It prints super letter-quality output and nice color graphics at moderately high speeds.

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Hush money. Forget its desktop publishing, speed and graphics capabilities. The LaserImage 2000 is worth \$3,495 (much less than the leading first generation laser printer), just for the fact that it replaces clatter with a whisper. And,

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LaserImage 2000.



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DOT MATRIX—\$1,850–\$1,995

auto-slant (to emulate italics in any font), double-wide character printing, and a wide graphics mode for 15.1-inch printing.

Programming also gives you impressive color printing. A single command creates any one of 14 colors from the 4-color ribbon (cyan, magenta, yellow, and black), while combinations of commands produce an apparently unlimited array of vivid colors.

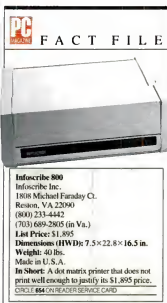
Sorry, folks, there are a couple of weak points. For one, the JDL 750e does not support the IBM high-order character set. Worse, while the documentation contains adequate information about setup, installation, default settings, error codes, and trouble-shooting, as well as full-feature code reference tables, it neglects to explain the JDL 750e's features. There are separately available programming and maintenance manuals, but a \$1,850 printer should include all of the necessary documentation.

Overall, the JDL 750e is a big, solid machine, both in terms of its physical appearance and in the quality of its output and features. While this printer is not only for power users, beginning users need a better manual to cope with its many fine features.—**Bruce Brown**

Infoscrite 800

There are probably 8 million marketing stories about why products like the Infoscrite 800 should exist in the Naked City of Printers. The first sentence of the Infoscrite 800 manual, for example, points out that the printer prints to within .05 inches of the tear-off bar and says that "the machine will pay for itself after printing approximately 30,000 forms." Given the suggested retail price of \$1,895, the number of forms seems a little low, but accurate forms processing is one of this printer's few redeeming features.

The PC Magazine Labs printer speed test of the Infoscrite yielded 108 characters per second, and in near-letter-quality mode the speed dropped to 35 cps—very slow speeds for a printer in the \$2,000 price range. The test may not be a true indicator, though, of how fast the printer can print jobs using preprinted forms because the Infoscrite 800 has a feature called VFU (vertical format unit), which allows it



to slew (vertically tab) from printed line to printed line. Since preprinted forms often have a number of lines between printed data, it's faster to slew than to do multiple line feeds through each blank line.

The print quality is fair at best, even in the near-letter-quality mode. Worse, the printout is sometimes marred by lines inadvertently drawn by the printhead when the paper is advanced. Also, the printer will not print in more than one print mode on the same line. And it cannot perform some combinations of type styles, such as printing letter quality mode double-wide. Also, neither italics nor proportional print is available except as optional ROM character sets.

The Infoscrite 800 makes a loud racket. The cover is heavily padded with foam rubber, but this is still not sufficient to bring the noise down to acceptable levels. With the cover off, the rat-a-tat-tat of the printhead will really pound your eardrums.

The Infoscrite 800 uses a ribbon cartridge, which snaps into place around the printhead. Five touch-sensitive switches on the front panel and conveniently placed DIP and wheel switches underneath the front cover (with a label that describes their

functions) offer easy access to the print features. The modern Infoscrite 800 would look well in most offices, but the top cover, unhinged and held on by magnets, is awkward to deal with. Also, the back cover does not fit well and, once removed, is difficult to screw on again. Loading paper is also a bit tricky.

The Infoscrite 800 had trouble with all of the PC Labs compatibility tests. Although it emulates Epson, Diablo 630, and IDS Prism command sets, it uses only subsets of each. Using the IDS command set in graphics mode, the Infoscrite 800 could not print the standard test pattern, but it did print graphics from 1-2-3. In the text mode, problems with horizontal line spacing occurred frequently.

At \$1,895, the Infoscrite 800 has far too many flaws in terms of speed, print quality, and compatibility to merit recommending it for any purpose other than forms processing.—**Joe Desposito**

OT-700e

Output Technology Corp.'s OT-700e is a formidable machine, with an enormous footprint and a width of well over 2 feet. When you flip open the top cover, your eyes take in a 16-inch platen and three printheads positioned across the ribbon path. With a rated speed of 700 characters per second, OTC is clearly positioning this unit for the shop that needs a high throughput rate with minimal downtime.

The OT-700e resembles the "shuttle-head" printers common in the early sixties for mainframes, which attained incredible (for then) speeds with a complete printhead assembly every five positions across the platen. The OT-700e uses multithread logic to push moderate-speed head motion to an effective print rate of around 570 cps, since the printing chores are spread across three heads, not just one.

For a production printer, print quality is excellent, and the OT-700e performs well in its Epson FX-100 graphics mode (low and high resolution). This is not the printer you would pick for letter writing, but that's not its target market. You pay for the speed of the OT-700e, though, in above-average noise levels; it tested at 83 decibels on the PC Magazine Labs test.

Setting up the OT-700e is easy. The



well-organized manual, with separate sections for users and programmers, gets high marks for content and format. Unfortunately, you will need bifocals to read the supersmall print unless your eyesight is a lot better than mine.

The OT-700e has two paper paths—bottom and front—but there's no rear load for standard desk usage. Paper does load easily, even when pushed in from the front. The platen accepts form widths over 16 inches, and the tractors will compress down for one-up labels less than 4 inches wide. If necessary you can buy a user-installable replacement kit for the triple-head shuttle for just \$162. Alignment should be no problem, since the bracket supporting the head array is rigid and the whole print mechanism floats on flex mountings.

If your print jobs include a significant amount of draft mode printing in the full 136-column format, you might well take a close look at the OT-700e, for here's where the machine's speed comes into play. If much of your work is in formats under 100 characters per line, you will effectively lose use of one of the printheads, with a resultant drop in print throughput. The PC Labs speed test used a two-page

letter, with a width that barely brought the second head into play. My tests ran in the 180- to 190-cps range as a result.

The OT-700e is a narrowly focused machine. If you fit its focus on speed and sturdiness, it can do the job for you.

—John Phillips

OT-700n TriMatrix

The first feature of the OT-700n TriMatrix that catches your eye is its sheer size, giving the impression of strength and durability. The second thing is its set of three printheads that print simultaneously. Built for speed and endurance, the OT-700n is an imposing piece of hardware intended for the sole purpose of high-speed data runs. In fact, the OT-700n's benefits may be lost on many PC users.

The three-head design, also called a "shuttle head," has its roots in the world of mainframe printers. The concept is that you can achieve higher than usual print speeds by sharing the responsibility for total printing width among the number of printheads available. Therefore, if there are three heads, each is responsible only for one-third of the printing width. The advantage of this design is lost, though, if you're not doing full-width printing.

The OT-700n has a total platen (printable) width of 16 inches. Each printhead therefore covers roughly 5 1/3 inches of paper. Usual printer speed tests, such as the PC Magazine Labs printer speed test, don't measure the speed of this printer effectively because the OT-700n will print a 15-inch-wide document just as quickly as a 5- or 10-inch-wide one. As a result, the OT-700n achieves only a disappointing 192 characters per second on our test. Theoretically, the OT-700n would be able to score at least twice that speed if the PC Labs test letter were formatted for 15-inch-wide paper.

The OT-700n, which emulates Epson LQ 1500 letter quality type, is one of a family of three printers. Its big brother, the OT-700e, comes with the IBM PC character set, a bigger buffer (8,000 rather than 4,000 characters), and 6- and 12-character-per-inch pitches. Its little brother, the plain 700, has neither letter quality mode nor the IBM PC character set. The OT-700n's letter quality capabilities are not



FACT FILE



OT-700n TriMatrix

Output Technology Corp.
E. 9922 Montgomery, #6
Spokane, WA 99206
(509) 926-3855

List Price: \$2,095

Dimensions (HWD): 6.0×27.38×16.7 in.

Weight: 34 lbs.

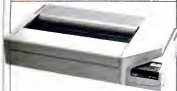
Made in U.S.A.

In Short: A three-printhead printer designed and built for long, high-speed data runs that don't require correspondence quality type.

CIRCLE 688 ON READER SERVICE CARD



FACT FILE



OT-700e

Output Technology Corp.
E. 9922 Montgomery, #6
Spokane, WA 99206
(509) 926-3855

List Price: \$1,995

Dimensions (HWD): 6.3×27.3×16.7 in.

Weight: 34 lbs.

Made in U.S.A.

In Short: A serious contender for high-volume printing in a draft production or LAN environment where speed is more important than print quality.

CIRCLE 689 ON READER SERVICE CARD

documented, however, and we discovered them only during a conversation with the manufacturer. Subsequent testing found the LQ 1500 mode available, though the print quality is not very good.

The OT-700 family has an interesting menu-driven setup system. If you hold the reset button while powering on, these printers will prompt you with questions about system setup. You can answer with a yes key or a no key; the responses will then be in effect. For example, the first question asked by the OT-700n is, "Letter Quality Off?" If you answer "yes," the printer will stay in draft mode; answering "no" turns on letter quality type. When you use the printer rather than the PC to select parameter settings this way, you get a printed copy of the settings when you finish or exit the setup mode. This system sure beats setting DIP switches. Another convenient feature is the ability to perform multiple-copy printing.

Both draft and letter quality modes are rough, but remember, the OT-700 series machines are not intended for correspondence. Also, if you use the OT-700n, you'll want to buy an acoustical cover; the printer pounds away at 88 decibels.

Every feature of the OT-700n underlines its heavy-duty, high-speed data-

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printing purpose. It's a fast, loud printer built to print all day and all night, with only so-so character print quality. Typical PC business users should leave the OT-700 series to the mainframe and minicomputer worlds.—**Bruce Brown**

DataProducts 8070 Plus

The DataProducts 8070 Plus is a high-speed dot matrix printer equally at home banging out long data runs and printing single copies of quality type. Its 18-pin printhead also prints with a color ribbon to produce charts and graphs.

The DataProducts 8070 Plus has two personalities, a P-Series mode and an IBM-compatible mode. The P-Series mode works with software written to work with a range of DataProducts printers (formerly IDS printers). In IBM-compatible mode the printer works like other DataProducts printers as well as the IBM Color and 5152 Graphics printers.

The 8070 Plus offers three print qualities and speeds. The highest speed, which produces a very readable draft-quality print, measured 192 characters per second on the PC Magazine Labs benchmark test. The slowest speed, which produces excellent near-letter-quality print, is 58 cps. A middle level, called "text quality," is a compromise of type quality and speed and is probably not used much. I'd be comfortable using the draft-quality face for mailing labels and memos but would jump to the NLQ mode for correspondence and final drafts.

The preliminary operating guide that came with the 8070 Plus included clear instructions for unpacking it and setting it up. The 8070 Plus includes a large paper catcher, a convenient component given the speed at which this printer can turn out work. Both serial and parallel interfaces are standard.

The 8070 Plus has three feed paths for continuous-form paper: front, bottom, and rear. Rear feeding is preferred but I used front feeding and had no problems. This adaptability is unusual but realistic given the odd tables, desks, and workstations on which printers are placed.

You complete the 8070 Plus's setup by



DataProducts 8070 Plus
DataProducts Corp.
6200 Canoga Ave.
Woodland Hills, CA 91365
(800) 258-1386
(818) 887-8000
List Price: \$2,099
Dimensions (HWD): 9.5 x 24.3 x 13.6 in.
Weight: 40 lbs.
Made in U.S.A.
In Short: A heavy-use, high-speed, IBM-compatible printer that produces an excellent near-letter-quality print and also is able to print in color.
CIRCLE 18 ON READER SERVICE CARD

choosing the printer emulation mode and then setting the printer parameters such as character set, characters per inch, and form length. In all, you can set 22 parameters using the printer's front-panel form-feed, line-feed, reset, forms, test, and ready keys.

The 8070 Plus met or exceeded my expectations for speed and good type quality, but it really surprised me on noise level—I anticipated that this big banger would be loud and I chuckled when I saw the factory's sound rating of 65 decibels. Few printers ever perform close to their ratings during testing, but the 8070 Plus scored only 72 decibels, the result of a sturdy case and ample soundproofing.

The 8070 Plus successfully printed both the low- and high-order IBM PC character sets. It also passed the PC Labs text compatibility tests for both the Epson MX-80 and the IBM Proprinter. It passed the graphics compatibility test handily too. Its color printing was deep and bright.

The DataProducts 8070 Plus is a good-sized machine that makes its presence known by its performance. It's just right as

a heavy-use office printer that will, on command, print fast, print clear type, and print color. Its high degree of IBM compatibility also makes the 8070 Plus a good choice.—**Bruce Brown**

Printek FormsPro 2000

Printers such as the Printek FormsPro 2000 that pull paper up from below have certain advantages. They avoid the "bent-paper syndrome" that results from a sheet of paper spending the weekend wrapped around the platen, and the foul-up that occurs when a printer refeeds finished pages accidentally. But those little pluses aren't enough to enable the Printek FormsPro 2000 to live up either to its promise or to its cost.

Obviously intended for heavy business use, the FormsPro 2000 is a strongly built dot matrix impact printer that's compatible in character mode with the Diablo 630 printer. It's mounted on its own pedestal and comes with one cover, which snaps on easily and muffles the printer's noise effectively.

Above the switches and indicator lights on the right side of the front panel are three DIP switch panels with which you can alter the FormsPro 2000's available modes. One switch controls defaults for fonts, print quality, or character sets; the second handles functions such as character pitch, form length, and lines per inch; and the third adjusts the printer for parallel or serial interface. The switches are hidden by the printer cover, and a guide to their functions is attached to the cover's underside.

The FormsPro 2000 offers both draft and high-quality type styles. The draft quality is unexpectedly coarse for an 18-pin printhead. The Executive Quality type, however, is an entirely different story, looking for all the world like fully formed type. Too bad this printer can't handle single-sheet feeds, because it means you can't use your personalized letterhead for correspondence. Executive Quality ran at 53 characters per second in the PC Magazine Labs test, which is a good steady speed but not unusually fast.

Unfortunately, I was unable to test the quality of the FormsPro 2000's graphics.

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Obviously

intended for heavy business use, the FormsPro 2000 is a strongly built dot matrix impact printer.



Printek FormsPro 200
Printek Inc.
1517 Townline Rd.
Benton Harbor, MI 49022
(616) 925-3200

List Price: \$2,195
Dimensions (HWD): 10.25 x 24 x 16.7 in.
Weight: 35 lbs.
Made in U.S.A.

In Short: A sturdy bottom-loading printer that produces excellent-quality type but with some drawbacks that definitely handicap it in a market full of friendlier machines.

CIRCLE 666 ON READER SERVICE CARD

According to Printek's technical help, the FormsPro 2000 is, as far as graphics are concerned, its "own creature"; I tried running it through the Epson, IBM, and Diablo graphics setups—all with no success. The printer's documentation is clear and well illustrated, but some sort of notebook should come with it to hold the shrink-wrapped pages together.

The Printek FormsPro 2000 struck me as old-fashioned in its approach. Its general inflexibility, lack of advanced capabilities, and fairly high cost put it at a distinct disadvantage in a market full of friendlier, more-sophisticated machines.

—Barbara Krasnoff

Mannesmann Tally 490

By any standards, the Mannesmann Tally 490 is an impressive machine. It's fast, quiet, and has an air of rugged reliability that is matched by few other printers. By the time I finished running it through the PC Magazine Labs tests, it had become my favorite dot matrix printer.

Just looking at the MT 490 is enough to tell you that this is a heavy-duty machine. It demands more desktop real estate than most dot matrix printers, but its sheer massiveness promises to deliver more as well. And it does, managing 247 characters per second in draft mode and 123 cps in near-letter-quality mode. The only surprise was how quietly it did so, printing with a low-pitched white noise effect rather than a high-pitched whine at 67 decibels in draft mode and 65 decibels in NLQ mode. That's quiet enough to let you talk comfortably on the phone while the printer does its stuff.

The MT 490 gets high marks for print quality as well, producing highly readable draft quality and a true NLQ mode. If you study the NLQ characters closely enough, you can see the telltale signs of a dot matrix printer, but for most purposes they are acceptably solid—thanks mostly to the 18-pin printhead. Graphics output is also impressive. It has both an Epson-compatible mode and an IBM-compatible mode. In both modes, the printer breezed through the text- and graphics-compatibility tests. The high-resolution graphics in particular are suitably dark and solid.

There's one complication in producing high-quality output with this printer. The MT 490 has a "paper thickness compensation lever" that adjusts the distance between printhead and paper in exceedingly small increments. It takes some experimentation to get things right. I'd be happier if Mannesmann Tally indicated the ap-



Mannesmann Tally 490

Mannesmann Tally
8301 S. 180th St.
Kent, WA 98032
(800) 843-1347
(206) 251-5500
List Price: \$2,199
Dimensions (HWD): 9.4 x 26.3 x 18.2 in.
Weight: 79.5 lbs.
Made in Germany

In Short: A fast, quiet printer able to produce high-quality output—everything you're likely to need in a dot matrix printer.

CIRCLE 665 ON READER SERVICE CARD

propriate settings for the two or three most common weights for paper, but I suspect that in practice most users won't change the type of paper often enough to make precise adjusting for different thicknesses a serious problem. I also suspect that you can learn this skill quickly.

The only real problem then was figuring out how to load the paper. The seemingly obvious way was in fact wrong, yielding instant paper jam. The manual wasn't any help because it was written for a different sound cover and paper separator. After a few frustrating attempts, I called their technical support and followed instructions; sure enough, the paper jams disappeared.

It turns out that the second grid shipped with the printer interferes with the tractor feed. A Mannesmann Tally spokesman later told me that the printer is not supposed to ship with the second grid in it.

Still, I'm inclined to forgive these lapses because the printer does its basic job so well. Even at \$2,199, the Mannesmann Tally 490 offers value for the price. And, for the moment at least, it's my dot matrix printer of choice. —M. David Stone

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Genicom 3310/Color

Born in the U.S.A., the Genicom 3310/Color printer is as American as Bruce Springsteen: it's colorful, rough, tough, fast on its feet, versatile, and ready for action. The 3310/Color doesn't need a microphone—unfortunately, you can hear it when it's working. And, like tickets to Springsteen's concerts, it doesn't come cheap.

The Genicom 3310/Color offers acceptable letter quality and data processing printing at speeds of 69 and 123 characters per second, respectively—pretty good whether zinging along to "Cadillac Ranch" or "Your Home Town." The 3310/Color was designed for businesses that are as busy as The Boss, with a lot of data- and text-printing jobs, charts, and graphs that demand color.

You won't need kid gloves to handle the 3310/Color, but you will need plastic ones, thoughtfully supplied with the printer. Unless you want rainbow-hued fingers, use them when you're loading any of the printer's four standard color ribbons, which enable you to print in up to seven primary and process colors. I experienced some snags when loading fanfold paper, but after discarding the first sheet, I generally was able to feed the paper through the tractor feeds and up into the friction feeds (there's the rub!) without a hitch. The Genicom 3310/Color's designers should take another crack at the paper advance knob; it's embedded in the body of the printer, and so instead of turning it with your hand, you have to advance it with your thumb, which can develop a callous if you do much paper adjustment by hand. Genicom offers an optional automatic sheet-feeder for feeding single-sheet forms and letterheads, as well as an array of paper-handling accessories. The company strongly recommends using the paper rack and inlet guide accessories for feeding multipart forms—I can see why.

Like Springsteen, the Genicom 3310/Color has more than one hit song in its repertoire. It can perform three ways: ANSI X3.64, Diablo 630, or IBM PC Graphics. Instead of fiddling with DIP switches and escape codes, you can select printer modes and fonts by using the alphanumeric display on the printer's front panel. You can



Genicom 3310/Color

Genicom Corp.
One Genicom Dr.
Waynesboro, VA 22980
(800) 437-7468
(703) 949-1000
List Price: \$2,295

Dimensions (HWD): 6.3×25×16.1 in.
Weight: 36.5 lbs.
Made in U.S.A.

In Short: A heavy-duty dot matrix printer designed for high-volume, high-speed printing, but its print quality doesn't justify its high cost.

CIRCLE 147 ON READER SERVICE CARD

program print style, print mode, line or character spacing, forms setup, and both horizontal or vertical tabs by using the control-panel menus or escape commands.

Since the 3310/Color is built for high-volume jobs with tight deadlines, the emphasis is on speed and reliability rather than on the aesthetics of the print. The four character styles are high-speed data processing, compressed data processing, Courier Letter Quality, and compressed Gothic Letter Quality. Optional additional font styles are available as plug-in chips. The data processing font is clearly dot matrixy and the letter quality font, while fine for most correspondence, won't win any awards. One particularly unattractive letter is the W, which has serifs that point in toward the center, almost connecting.

The Genicom manual is clear and to the point, with different-colored pages for the three different emulations. The lengthy but helpful manual has not only an index but also a glossary of terms to help new or inexperienced users.

On the plus side are the Genicom 3310/Color's sturdiness, good but not great speed, ease of programming, and the pre-

viously mentioned clear manual. On the minus side are its so-so print quality, sometimes annoying paper-feed snags, and relatively high (but not unusual) \$2,295 price (compared with the Fujitsu DL2400, a solid performer that costs only \$1,395). The tough 3310/Color may be able to keep performing long after others have retired, but its ticket price and print-quality drawbacks are enough to lead most hardware buyers to join the fan club of another star. —Carol Olsen Day

TI 880 AT

The TI 880 AT doesn't appear to be mechanically much different from Texas Instruments' older 800 series that has been around since the mid 1970s. It's a little faster, with a rated speed of 300 characters per second and measured performance in the PC Magazine Labs test of slightly over 170 cps in draft mode. Character formation is improved, descenders have been added, and more sound-deadening material has been glued to the inside of the cases.

The TI 880 AT's noise level in draft print mode was recorded at 74 decibels. It sounds louder than that because of the harsh tones that escape from the front of the machine. This printer is intended to serve as a volume output device for a local-area network, and as such might well be attached to a server in the far corner of an office so that the noise would not be objectionable. You definitely wouldn't want it within a few feet of you all day.

The 55-pound printer, which uses almost 4 square feet of desk space, really requires a floor stand, since the straight-up-from-the-bottom paper path is otherwise blocked and the alternate rear-edge path tends to jam. When you lift its front cover, you see a control panel with 12 buttons and a 12-position rotary dial. Four of the buttons have double functions. Seven pages of pictorials are required in the so-called quick-reference guide to explain the use of the panel, and even then it takes some trial and error to get it right. TI still uses the old metal spools carrying a fabric ribbon, with a ribbon-reverse mechanism that doesn't look too strong. Replacement ribbons are under \$30 for a box of six, but you'll need a shower after you've threaded the bare ribbon through your fingers and around the

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The standard system has a "0" wait state on memory; and operates many times faster than the IBM PC/XT®. Offers 640 KB of RAM on

the motherboard; 360 KB floppy disk drive; eight expansion slots; LED indicator for the turbo mode; AT-style keyboard; 135-watt integral power supply; and security key lock. Optional features include a 40 MB hard disk (38 ms), EGA, and an 8087-2 math co-processor.

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FACT FILE

**TI 880 AT**

Texas Instruments Inc.
Data Systems Group
Dallas, TX 75380-9063
(800) 527-3500

List Price: \$2,295
Dimensions (HWD): 8×25×20 in.
Weight: 55 lbs.
Made in U.S.A.

In Short: A slightly updated version of the original OMNI 800 printer, with IBM compatibility, reasonable speed, and sturdy chassis but hard-to-learn control panel.

CIRCLE 636 ON READER SERVICE CARD

various rollers and guides in the ribbon path.

IBM compatibility is part of a \$100 option package that includes a 16K-byte buffer. Without this option, you get the standard 2K-byte buffer and a Gothic font but, unfortunately, lose the IBM-compatibility feature. With the option, the TI 880 AT is fully compatible with the IBM Proprinter in both text and graphics modes. ROMs with additional character sets are available for \$30 each. The TI 880 AT's graphics printing is a little sparse. To fill in the black areas in the graphics test completely, I found it was necessary to move the printhead so close to the paper surface that some smudging occurred.

The TI 880 AT lacks a simplified setup panel with color-coded membrane switches, an easy insert/remove ribbon cartridge, and the low profile and sleek lines of the newer units. But newer is not always better, and the TI 880 AT represents a time-tested mechanical design that has been proven for years to be trouble free and easy to operate—after it's been set up.

But considering the printer's highly competitive class and its current price,

The TI 880 AT uses a time-tested mechanical design that has proven to be trouble free and easy to operate—after it's been set up.

your return on investment may not be as great as the TI 880 AT's large volume capacity might suggest.—**John Phillips**

Hermes PC-4

Sharing its heritage with the Swiss watches that have a longstanding reputation for quality construction as well as premium price, the Hermes PC-4 is a fast, well-built color printer, but its price raises some concern about its overall value. And some of its quirks call to mind another Swiss export—cheese.

The Hermes PC-4, a wide-carriage printer with an external tractor-feed mechanism, is clearly a solid machine, as you find out the first time you try to lift its nearly 50 pounds out of the box. The most difficult thing about setting up the model that PC Magazine Labs tested, which included the color printing option, was threading the ribbon. I had a little trouble at first getting the ribbon installed so that it would print black without slipping onto the blue portion of the ribbon, but I soon discovered my error and fixed it easily, wearing the disposable plastic gloves that come with the ribbon.

The Hermes PC-4 uses an unusual 18-pin printhead, which produces acceptable but not outstanding print quality. The printhead travels on a large track, which should provide for good position accuracy, and graphics screen dumps indicate that the print registration is good. One of the two built-in character sets produces the IBM higher-order graphics characters (although the double-line characters look

more like single heavy lines).

A big plus is that the PC-4 emulates standard IBM and Epson escape sequences. For text, it can be set to perform as either an IBM Proprinter or an Epson MX series printer. For graphics, the manual indicates that it emulates the IBM 5152 Graphics Printer or the Epson FX series. It succeeded in performing flawlessly in both these areas.

Color emulation was more of a problem. I tried a series of drivers, both Epson and IBM color printer, but was able to get acceptable results from only the lowest-resolution color printer driver. I then turned to the American distributor for technical assistance, Singer Data Products, which had nothing to do with the design and manufacture of the printer. This last fact became increasingly obvious, since the technical support staff was not thoroughly familiar with the product and its options. Part of the problem was that the demonstrator model we had been sent had a ROM font cartridge installed that was not the same as the standard configuration.

My confusion about some of the printer commands turned out to be well founded,



FACT FILE

**Hermes PC-4**

Singer Data Products
790 Maple Ln.
Bensenville, IL 60106
(312) 860-6500

List Price: \$2,350
Dimensions (HWD): 11×24×20 in.
Weight: 49.5 lbs.
Made in Switzerland

In Short: A color printer that fails to deliver print quality or other performance premiums in keeping with its cost.

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Lotus 1-2-3	✓					✓		✓					495 ^{MS}
Symphony	✓	✓											695 ^{MS}
Framework	✓	✓	✓					✓					695 ^{MS}
Enable	✓	✓				✓	✓	✓	✓	✓	✓		695 ^{MS}
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At \$2,350

the Hermes PC-4 costs nearly twice as much as most other printers, including daisy wheels. It even costs more than some laser printers.

since we had also received the wrong manual for the printer. The documentation was skimpy, with no index or command summary. There was no mention of the color commands, nor of the different ROM fonts that evidently are available.

Hermes and Singer are optimistic about their machine: they rate it at 400 characters per second in draft mode and only 52 decibels in sound level. The PC Magazine Labs tests found less than 173 cps and 79 decibels. Even allowing for the different conditions and testing techniques, these results are dramatically different from the ratings.

Perhaps the most optimistic measure of all is the list price. At \$2,350, this printer costs nearly twice as much as most other printers, including daisy wheel printers. It even costs more than some laser printers. Other color printers offer better emulation and equal or better print quality for a third the price.

Although I see little reason to buy the Hermes PC-4, if you do buy one, make certain that you have a good source for the ribbons and that your dealer is able to demonstrate the printer working properly with the graphics programs you intend to use. Not only will this show you whether or not the printer can do the job, it will also make it clear whether or not you can rely on your dealer as a source of technical support. For after working with the Hermes PC-4, I suspect that cheese isn't the only product with holes in it that the Swiss export.

—Alfred Poor



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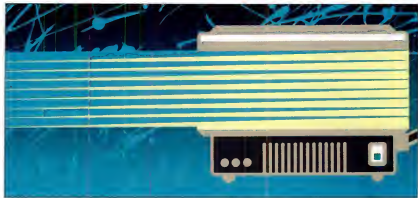
— PC Week

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Outline structure	Y	Y	Y
Autonumbering	Y	N	Y
Multi-line entries	Y	Y	Y
Sorting	Y	Y	Y
Numbering Formats	Y	0	?
Outline Table	Y	N	N
Hide/Unhide	Y	Y	Y
Save previous Hides	Y	N	Y
Global Hide/Unhides	Y	N	N
Hide Paragraphs	Y	Y	N/A
Start new numbering	Y	N	N
Skip numbering	Y	N	N
Force Entry left/right	Y	N	N
Xfer between outlines	Y	N	N
EDITING FUNCTIONS:			
Full screen editing	Y	N	N
Margin Control	Y	N	N
Hanging indents	Y	N	N
Justification	Y	N	N
Centering	Y	N	N
Search/Replace	Y	Y	Y
Block Copy/Move	Y	Y	N
Xfer between windows	Y	N	N
On screen Page Breaks	Y	N	N
Insert Page Breaks	Y	N	N
Tab Settings	Y	Y	N
Printer fonts	Y	N	N
Print any part	Y	N	?
MISC. FUNCTIONS:			
Memory Resident Option	Y	N	Y
Pull-Down Menus	Y	N	N
Windows	9	1	1
Zoom Windows	Y	N	N
Macros	Y	N	N
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*These two products are copy-protected and contain on-disk documentation. A complete printed manual accompanied by an unprotected disk is available for \$19.95 each plus \$1.00 shipping.

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CIRCLE 323 ON READER SERVICE CARD



LASER PRINTERS

JOHN DICKINSON

DESKTOP

LASER PRINTING IS A
2-YEAR-OLD BUSINESS THAT
BEGAN WHEN HEWLETT-PACKARD
INTRODUCED ITS CANON-ENGINE-BASED
LASERJET. HP WAS THE FIRST ONE OUT WITH A
WORKING, MODERATELY PRICED LASER PRINTER, AND
THE MACHINE WON THE HEARTS AND MINDS OF USERS AND

Hewlett-Packard is losing its monopoly on the laser printer
market as a host of competitors enters the fray,
offering new features and better
laser engines.

PC EDITOR'S CHOICE

Laser printers are more plentiful and less expensive than ever this year.

The QMS Kiss is the first laser printer to break the \$2,000 barrier. The \$1,995 Kiss can emulate the Epson FX-80 (including graphics and downloadable font), the Diablo 630, or the Qume Sprint, so you'll probably be able to use it right away with existing software.

More expensive but also more versatile is the \$3,495 CIE LIPS 10. This laser printer has a Konica engine rather than the more common Canon print engine, and it features Epson, Diablo 630, and HP Laserjet compatibility. Many of the features are accessible from a front control panel.

An honorable mention goes to the PostScript-based \$5,999 Apple LaserWriter Plus, which adds fonts to the Apple LaserWriter—an Editor's Choice last year. But if Apple is really serious about capturing the PC market, it'll have to supply more information in its manual and perhaps even a PC disk with some utility software and updated drivers.

software vendors alike. Even the first edition of the HP Laserjet offered superb print quality, excellent font designs housed in font cartridges, and fast, quiet printing that made the machine an obvious alternative to premium daisy wheel printers. As a result, most laser printers you see in corporate offices bear the familiar HP logo, and all the major word processing software vendors support the printer.

Of course, the highly competitive printer market is now catching up, and a wide choice of laser printers is available. Most of the HP competitors came out only this year. Some come from vendors that are traditionally in other businesses, and several use new and innovative laser engines made by vendors other than Canon.

Each competitor tries to offer something to distinguish itself from the Laserjet

and the newer Laserjet Plus and 500 models. In some cases that means additional graphics, including IBM/Epson-compatible graphics, in others it means compatibility with traditional daisy wheel printers (usually the Diablo 630), and in others it means superior front-panel controls and paper handling. Just to be sure, many of the interlopers add full or partial Laserjet compatibility.

Virtually all of them have the same objective: a piece of the laser printer market that HP has had to itself for the past 2 years. Read on to see how well they do!

—John Dickinson

Oasys Jato Card

Tired of buying a font cartridge every time you want your Hewlett-Packard Laserjet to print some really nice text? Need a typeface that is personalized and bound to attract your client's eye? Try the Oasys Jato Card, a replacement controller card for the HP Laserjet. The Jato Card gives you all the functionality of an HP Laserjet's card—and more. You get additional memory, emulation of four other popular printers, and an easily learned and used programming language that generates fonts. In essence, you get the equivalent of an Oasys LaserPro 810-R (reviewed elsewhere in this issue) for \$1,395.

The Jato Card replaces the HP Laserjet's controller card and front-panel display. (The deal is that you agree to send Oasys the HP's original controller card and display panel after you install the Jato Card.) While the card we tested came with 1.2 megabytes of RAM, Oasys says that future versions will be configured with 768K bytes of RAM—still more than the 512K bytes that come standard with the HP Laserjet Plus. The replacement front display panel controls virtually everything from emulation mode to page setup; this makes it easier to enter the codes and the values for changing such features as page length and margins, the active font, the number of copies, and the time before a form-feed is forced.

The RAM can be used to hold generated or downloaded fonts, either from cartridges or floppy disks. You download a font cartridge by inserting it and pressing the Up Arrow button on the front panel.

The font is then automatically scanned and downloaded. Because you can download more than one font cartridge at a time, you're relieved of the necessity of swapping cartridges whenever you want to switch typefaces.

As long as you follow the well-illustrated, well-written instructions, installation is as easy as slapping together a ham and cheese sandwich. You simply remove a few screws, unplug four cables, substitute the new for the old, and repeat your actions in the reverse order. Inserting a floppy disk into the A drive can be more difficult. About the only problem you may encounter is holding onto small screws with stubby fingers.

Once you install the card, the Laserjet has all of the features of the Oasys LaserPro 810 series, including emulation and font generation, with the Oasys Express programming language. At power-



Oasys Jato Card

Oasys
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(619) 576-9508

List Price: \$1,395 for replacement controller card and display panel (you must send in the controller and panel from your Hewlett-Packard Laserjet).
Made in U.S.A.

In Short: A replacement controller card for your HP Laserjet's controller and front control display panel that offers printer emulations and font generation.

CIRCLE 022 ON READER SERVICE CARD

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Inverted Foldout slip-sheet



GbsSlipSheet-001

Foldout slip-sheet

Folded edge of the page

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



001100Back-001100

Back

1. Follow instructions on the other side

CMO. Doing business-to-b

Person to person.

I have been in the retail business since 1971. I have always required my sales people to work hard, to know the products they sell and to be as helpful and informative as they can be in dealing with clients. The other day I read a letter from a client of ours addressed to my sales manager. The letter described a situation where the client was debating what system he should buy. Then he discussed his conversations with Ken Rinehimer, the sales consultant for CMO.

The following is an excerpt taken from that letter.

"One of the biggest arguments the local retail stores use in arguing against the purchase of goods from a mail order company is that 'you get no personal attention.' In my dealings with your company, I found that to be untrue."

"Recently I purchased a computer system from your company. My salesman was Ken who was the epitome of what a salesman should be...Ken was most helpful and professional. He was informative, giving recommendations as to the configuration the system should take and demonstrated a vast knowledge of what he was selling. In short, my experience with your firm was very good because of Ken Rinehimer who projects an excellent impression for CMO." It was signed Terrence Freeman, Stuart, FLA.

I like reading letters like this. In fact, knowing our staff at CMO, I expect to read letters like this. And you should expect good service from us.

One final note: It's nice to get good news like letters from Mr. Freeman. But it's probably more important to hear about your frustrations. As good as we get at what we do, there are bound to be occasional problems. Please share them with me. We want to keep pushing. To do that, we need your help.

R. Seth Stauffer

Marketing Director
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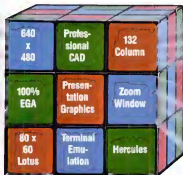
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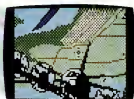
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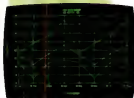


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CIRCLE 119 ON READER SERVICE CARD



up, the printer defaults to HP emulation; however, you can change the mode to Epson FX-80, Diablo 630, Qume Sprint 11, or NEC Spinwriter 3550 by entering the appropriate codes on the front panel either with a BASIC program or through your word processing package. (For more details on the quality of the emulations, see the Oasys LaserPro 810-R and CIE LIPS 10 reviews in this issue.)

The best feature of the Oasys Express programming language is its ability to generate fonts from the built-in, vector-stored representations. By filling in a few parameters such as the point size, degree of slant, and heaviness of boldface, you can create a font that is tailored to your specifications. The font is then saved in memory and can be used as any other downloaded typeface. The language has a number of other features, including the ability to print bar codes and draw primitive graphics. (If there is a feature you need that the Express language doesn't have, give Oasys a call—its designers are always looking for something to add.)

Before you actually run out and buy a Jato Card, you should consider these two points: If you have an HP Laserjet Plus, inserting a Jato Card means losing one of your ports since the card can be configured only for either parallel or serial but not both. Also, the Jato Card's list price of \$1,395 may be a bit steep. You might actually save money by selling your HP and buying an Oasys or CIE printer.

—Vincent Puglia

QMS Kiss

Hewlett-Packard set the printer market on its ear when it came out with a laser printer for \$4,000 2 years ago. Now QMS has kept the shock wave rolling with the first laser printer under \$2,000—the QMS Kiss. The big question is: What do you give up with a laser printer so low in price? The answer appears to be: not much.

The Kiss is another Canon-engine laser printer, rated at eight pages per minute. It comes with a parallel interface, making it a snap to install with your computer. Any IBM parallel cable will probably work with it, and after you have inserted the Canon cartridge (photosensitive drum and toner in one convenient package), you just

turn on the Kiss and start printing.

As part of its initial self-test, the Kiss prints out a status sheet that lists all the defined fonts and shows the different configuration options. The status sheet shows 9 different fonts, but most manufacturers

In the PC Labs graphics benchmark test, the QMS Kiss exactly emulated an Epson FX-80 in both regular and high-resolution modes.

would claim 12; since the 3 Epson fonts have italics as their high-order characters, you can use 12 full alphabets of different fonts.

The Kiss will print out a set of sample pages showing you the available fonts, one to a page. The Epson fonts are plain, sans-serif fonts. The two QMS fonts are also sans serif, but a bit bolder. The portrait mode font is a large 16-point, 7-character-per-inch font, while the landscape font is a tiny 5-point, 16.7-cpi font similar to that of the HP Laserjet "Line Printer." The Kiss also has 10-pitch Courier and 12-pitch Prestige fonts built in. There are no proportional fonts, but you can print the Epson fonts with proportional spacing for a fairly nice effect.

Another option indicated on the status sheet is the Print Mode, which offers three different emulation modes. In addition to its own escape command sequences, the Kiss also accepts commands as if it were an Epson FX-80, a Diablo 630, or a Qume Sprint. The manual does an excellent job of documenting each of these command sets; it clearly lists the commands that are supported and those that are not. (Some commands, such as those for bidirectional printing and double-strike, have no func-

tion on a page printer such as the Kiss and therefore are not implemented.)

The emulations are excellent. The PC Magazine Labs text benchmark test worked without a problem for both the Epson and the Diablo mode (we didn't have a Qume Sprint benchmark test). The only flaw is that the boldface print is not bold enough; the Diablo "shadow" print produces a more effective boldface. In the PC Labs graphics benchmark test, the Kiss exactly emulated an Epson FX-80 in both regular and high-resolution modes. Note that while the Kiss has a 300-dot-per-inch resolution, its Epson graphics will be sharper but with no finer detail than the Epson it's imitating. You cannot get the 300-dpi bit-mapped graphics available on more expensive lasers such as the HP Laserjet.

The status sheet also shows the current page orientation (portrait or landscape), margins, and paper size. It tells you the number of copies it will print of each page you send to it and the total number of pages printed by the print engine to date—a useful piece of information. The printer uses up the toner cartridges at varying speeds, depending on the print density of what you print. A mechanical indicator gives you a hint about how long you have used the cartridge (the window turns from green to yellow and then to red after about 3,000 pages), but if you use the information from the status sheet as a guide, you'll have a much better idea of how many pages you actually get per cartridge.

Since laser printers appear to push out paper faster than any printer I've ever owned, it's a good idea to know how many pages you have used. We went through over 100 pages in just a few hours of testing in the PC Labs. The Kiss's Canon engine has a counter that will give you the same information, but it's hard to find and you have to open the machine to look for it. Each time you turn on the printer, though, the Kiss's status sheet tells you how many pages you've used—an easier-to-use method.

Next to the emulation modes, perhaps the best thing about the Kiss is that you can get at nearly every option and setting through the buttons on the indicator panel; QMS refers to these buttons as the "keyboard." Getting the hang of this keyboard takes a little work. Although I read the

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manual's instructions a few times and the concepts made sense, I still didn't grasp the techniques of setting options this way. I then turned to an optional on-disk tutorial that QMS provides; saddled with the terminally cute name of "1st Kiss," it's nevertheless quite instructive. After just a few minutes with the disk, I was able to return to the manual and make sense out of the keyboard procedures.

The buttons on the Kiss allow you to set dozens of parameters: emulation mode, emulation commands, font selection, page formatting, and more. The status sheet lists all these settings, and when you power up the printer, you'll find that 29 of these soft "switches" have been set. You call up different "groups" and then can toggle one or more options within that group on or off. The power and the flexibility are limited, but just barely. No longer must you exit your application to make a small change in your printer's settings if the printer is not just what you wanted. You

can even change the power-on default settings. You need to have the manual close by as you make the changes, but a little practice will make the process easy and natural for you to do.

The Kiss has a few other nice touches. It supports the Epson downloaded font commands, and so you can download your own fonts (or third-party fonts). None of the built-in fonts can print the IBM higher-order line-drawing characters; if you need any of these characters (for example, for printing business forms), you can download them.

The Kiss's manual is not exactly perfect, but it's closer in quality to a good software manual than to a typical printer manual. It has large, separate sections for each of the three emulation modes and another section on the advanced command set. There are useful appendixes, although the section on using the Kiss with applications programs is a bit skimpy (it refers only to *DisplayWrite2*, *1-2-3*, and *XyWrite II*). The index is useful, but it could be double its size.

Overall, the Kiss presents unparalleled value in the printer market today. Its range of emulations give painless access to text and graphics with just about every applications package. Its fonts are not elegant, but they're more than adequate for most purposes. Also, the Kiss is a cinch to install and operate. At its less-than-\$2,000 list price, the printer is priced to compete not with other page printers but with top-end daisy wheel printers. In this competition, its speed, quietness, quality, and versatility make the Kiss a hands-down winner. So if you're in the market, consider giving your PC a Kiss. —**Alfred Poor**

The Blaser

Here's a laser printer that works like a printer, not like a fancy copier with an esoteric programming language. Right out of the box, The Blaser is ready to go. All you have to do is put in the toner cartridge, load some paper, plug in the power cord, hook up the printer with a parallel printer cable, and then turn it on. If you pretend that The Blaser is an IBM 5152 Graphics Printer, you can proceed with your usual software, and in most cases The Blaser will act like the fastest, quietest IBM 5152 Graphics

Printer that you have ever seen.

Most people buy laser printers for print quality, speed, and low noise level. If you want one with a built-in page-composition language, you'd better look elsewhere. But if your needs are simpler, The Blaser may well suit them.

The Blaser is based on the Canon laser engine and looks similar to the Hewlett-Packard Laserjet. It has a different control panel from the HP printer, but the rest of its external features are identical to those of HP's printer. Its toner cartridge loading, paper loading, speed, and noise level are like those of other Canon-engine printers. The Blaser comes standard with both parallel and serial printer ports.

Five flat-panel switches and eight indicator lights give you control and monitoring of the printer's features. A notably different control is the Extra Copies switch. Without having to fiddle with any software, you can tell The Blaser to print up to four copies of a document just by pressing the Extra Copies switch the right number

PC MAGAZINE EDITOR'S CHOICE FACT FILE



QMS Kiss

QMS Inc.
P.O. Box 81250
Mobile, AL 36689
(205) 633-4330
List Price: \$1,995
Dimensions (HWD): 11.5x18.7x16.3 in.
Weight: 65 lbs.
Print engine made in Japan; controllers made in U.S.A.

In Short: The first laser printer to list for less than \$2,000; its ease of use offsets the limitations on fancy graphics.

CIRCLE 681 ON READER SERVICE CARD

PC MAGAZINE EDITOR'S CHOICE FACT FILE



The Blaser

Blaser Industries
6382 Arizona Circle
Los Angeles, CA 90045
(213) 674-3117
List Price: \$2,795
Dimensions (HWD): 11.4x18.5x16.2 in.
Weight: 66 lbs.
Made in Japan

In Short: An easy-to-use, Canon-engine-based laser printer with built-in IBM Graphics Printer emulation.

CIRCLE 682 ON READER SERVICE CARD



LASERS—\$2,795

of times. Through software control you can instruct The Blaser to print up to 256 copies of a document.

The Blaser comes ready to work for most word processing, spreadsheet, and database tasks. Without any additional font cartridges or fancy programming, it will print boldface, underlining, superscript, subscript (in very tiny letters), and compressed print. Double-wide 5-character-per-second print is also standard. The one popular pitch not standard with The Blaser is elite (though it's not available on the IBM 5152 Graphics Printer either). And unlike the HP Laserjet, The Blaser can't backspace; so it will have problems with codes that call for a backspace, such as *WordStar's* code for underlining.

All the available fonts will print in either portrait or landscape orientation on a page. You cannot mix portrait and landscape on the same page with The Blaser, as you can with the QMS Kiss, but switching between landscape and portrait modes is as simple as sending the printer an "Esc ?" or an "Esc a" (which are the codes to change page orientation).

The font cartridges Blaser Industries sells for The Blaser each include either one or four fonts. Single-font cartridges cost \$99; four-font cartridges are \$289. The four-font cartridges have indicator lights for each of the fonts and a pressure switch that will select one of the cartridge fonts as the default font. You can use up to eight different fonts on a single page if your software supports them as well.

Although the manual I received for The Blaser was marked "draft," it's better than many other printer manuals. Blaser Industries uses helpful photographs mixed with line drawings extensively in the manual, especially in the section on setting up the printer. One section gives specific instructions on how to use The Blaser with *WordPerfect*, 1-2-3, *Super Calc 3*, and *Managing Your Money*. Brief tips are offered for using *Framework*, *KnowledgeManager/2*, and *The Harvard Project Manager*.

Since laser printers came on the market a couple of years ago, accountants, lawyers, and many other professional offices and businesses have made them a standard item. Prices have decreased somewhat but not drastically; they now range from just

under \$2,000 to over \$7,000. The Blaser is an especially easy-to-set-up-and-use laser printer that functions well, but at \$2,795 it's not the least expensive one on the market. —Bruce Brown

Qume LaserTEN

If looks were everything, the Qume LaserTEN would be a clear winner; it is a cool-looking light gray with rounded pastel control buttons. Many people commented on the LaserTEN's "designed" look while it was at the PC Magazine Labs. It's a Hitachi-engine-based laser printer with changeable emulation interface modules, and its personality changes with its interfaces—a fickleness that goes along with its Miami Vice colors and quirky serial connections.

Depending on the interface used, the Qume LaserTEN can emulate an IBM

Proprinter, Hewlett-Packard Laserjet, or Hewlett-Packard Laserjet Plus. This fall a three-in-one interface will be available that will allow the LaserTEN to emulate an IBM 5152 Graphics Printer, IBM Proprinter, and Epson FX-85. The unit we tested came with the HP Laserjet emulation interface.

The LaserTEN is touted as a 10-page-per-minute printer. Even though the actual speed as measured by the PC Labs benchmark test is just less than 9 pages per minute, that's about 2 pages per minute faster than the Hewlett-Packard and other Canon-engine laser printers. Just as the HP Laserjet will only print in Courier 10 without additional cartridges, the LaserTEN gives you very little without its own cartridges, called Digifont cartridges. The LaserTEN will accept up to three Digifont cartridges at one time, to give access to other than the default Courier 10 font.

The LaserTEN has a 250-page paper-feed bin and a 100-page output tray. The paper-feed tray will accept three standard paper sizes: legal, letter, and A4 (8.27 by 11.69 inches). The LaserTEN will take odd-sized sheets and envelopes with manual-feed.

Even if you usually hate computer manuals, you may like Qume's. The documentation is very short but covers the essential information. The guide to operations devotes 8 of its 21 pages to setting up. Setting up takes about an hour. Be careful using the toner; even though it's in a cartridge it's possible to get some on you, as I did.

During setup you are required to put together several pieces of the machine, including the drum cartridge, toner hopper/developer cartridge, toner cartridge, and toner residue bottle. This procedure is a good learning experience because the parts you put in now you will also be putting in later as you eventually replace components. Qume has designed the machine to be user maintainable; periodic maintenance is covered in the guide to operations. I was a bit overwhelmed at first when I saw all the pieces that had to be put together, but the procedure went quickly and well.

Making the LaserTEN communicate with a PC or compatible is another story. You must acquire a null modem cable to make your PC communicate through its serial port to the LaserTEN. Fortunately,



Qume LaserTEN

Qume Corp.

2150 Qume Dr.

San Jose, CA 95131

(408) 942-4000

List Price: \$2,795

Dimensions (HWD): 20 x 17.25 x 11.5 in.

Weight: 84 lbs.

Made In Japan

In Short: The Qume LaserTEN is a 10-page-per-minute laser printer that can emulate the Hewlett-Packard Laserjet, but getting it to listen to your computer entails more-than-necessary aggravation.

CIRCLE 608 ON READER SERVICE CARD

The Write Stuff

**AST TurboLaser:
full-page 300 dpi
HPGL graphics
so fast it leaves
LaserJets on
the runway.**

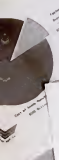


AST's TurboLaser has it all. The best combination of high-speed, sharp graphics, typeset-quality text and unlimited software compatibility on the market. Printed in a moment's notice, newsletters, charts, letters, drawings, reports, forms, manuals and more, never looked more professional. Judge for yourself - feature-for-feature AST's desktop laser printer writes off the competition.

TurboLaser Versus LaserJet Desktop Laser Printer Comparison

Feature	AST TurboLaser	HP LaserJet PLUS	HP LaserJet 500 PLUS	HP LaserJet 500 PLUS
Original Pages per Minute Speed (text and graphics)	8	<8	<8	<8
Full Page 300 dpi Graphics	Yes	No	No	No
HPGL Graphics Compatibility	Yes	No	No	No
1.5 MB RAM	Yes	No	No	No
Built-In Rasterizer (RIP)	Yes	No	No	No
Wide Variety of Standard Fonts, Styles and Sizes (resident and instantly accessible)	Yes	No	No	No
Wide Range of International Fonts	Yes	?	?	?
Built-in Page Description Package	Yes	No	No	No
Standard Serial and Parallel Interface Support	Yes	No	No	Yes
Input Tray Capacity (pages)	250	100	100	500
Output Tray Capacity (pages)	250	20	20	500
Correlated Face-Down Output	Yes	No	No	Yes
Diablo 630 Emulation	Yes	Yes	Yes	Yes
Epson Emulation	Yes	Yes	Yes	Yes
Monthly Duty Rating (pages)	5K-10K	2-3K	2-3K	2-3K
Life Expectancy (pages)	600K	100K	100K	100K
Fully Compatible With All AST Products:	Yes	?	?	?

Our FANTASY SYSTEM



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Feature	AST TurboLaser	HP LaserJet PLUS	HP LaserJet 500 PLUS	HP LaserJet 500 PLUS
Monthly Payment	1,100	1,100	1,100	1,100
Annual Payment	13,200	13,200	13,200	13,200
Monthly Payment	1,100	1,100	1,100	1,100
Annual Payment	13,200	13,200	13,200	13,200
Monthly Payment	1,100	1,100	1,100	1,100
Annual Payment	13,200	13,200	13,200	13,200
Monthly Payment	1,100	1,100	1,100	1,100
Annual Payment	13,200	13,200	13,200	13,200
Monthly Payment	1,100	1,100	1,100	1,100
Annual Payment	13,200	13,200	13,200	13,200



Eight "ORIGINAL-Pages-Per-Minute" Speed.

AST prints originals at the rate most laser printers can only produce additional copies. Other desktop models boast eight-pages-per-minute, but are referring to the time it takes to make copies of an original. Printing eight-ORIGINAL-pages-per-minute, TurboLaser obsoletes the "pages-per-minute" standard.

Full-Page, High-Resolution Graphics. Complete 8 1/2" x 11"-page graphics with 300 dpi (dots per inch) resolution makes TurboLaser an ideal business graphics and CAD/CAM presentation tool. The competition is confined to small "token" graphics output.



Wide Range of Emulation Capabilities and Software Compatibility. TurboLaser provides a complete emulation of HPGL, the plotter language used by over 90 percent of all business graphics and CAD/CAM software. Likewise, TurboLaser fully emulates Lasergraphics Language™ (L1) and popular printers, such as Epson®, Diablo 630® and the extended 630 (X-630®). As a result, you can print virtually all PC-based application software, including Lotus®, Symphony®, Framework®,

WordStar®, dBASE®, Chart®, Word®, etc., and CAD/CAM graphics such as AutoCAD®, CADVANCE®, VersaCAD® and many others.

Multiple Fonts, Styles and Sizes. Perfect for desktop publishing, TurboLaser provides a wide variety of fonts, type styles and point sizes for versatile and creative communications.

Sophisticated Paper Handling. Run large print jobs unattended with TurboLaser's large input and output trays. And face-down output reduces collating time, so you can produce reports on the run.

Full Compatibility With AST Products. Best of all, there's never a question of compatibility with AST's present and future products, including data communications, local area networks and micro-to-mainframe solutions.

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AST Research, Inc.,
Subsystems Group,
2121 Alton Avenue,
Irvine, California
92714-4992.

A Few of the Standard Fonts:

LETGOTH	ABCEDEFGHIJKLMNOPabcde fghi jk lmnop123
LETGOTH	ABCEDEFGHIJKLMNOPabcde fghi jk lmnop123
LETGOTH	ABCEDEFGHIJKLMNOPabcde fghi jk lmnop123
COURIER	ABCEDEFGHIJKLMNOPabcde fghi jk lmnop123
COURIER	ABCEDEFGHIJKLMNOPabcde fghi jk lmnop123
COURIER	ABCEDEFGHIJKLMNOPabcde fghi jk lmnop123
DUTCH	ABCEDEFGHIJKLMNOPabcde fghi jk lmnop123
DUTCH	ABCEDEFGHIJKLMNOPabcde fghi jk lmnop123
DUTCH	ABCEDEFGHIJKLMNOPabcde fghi jk lmnop123
SWISS	ABCEDEFGHIJKLMNOPabcde fghi jk lmnop123
SWISS	ABCEDEFGHIJKLMNOPabcde fghi jk lmnop123
SWISS	ABCEDEFGHIJKLMNOPabcde fghi jk lmnop123

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AST

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AST Research, Inc. 2121 Alton Avenue, Irvine, CA 92714-4992 Attention: Subsystems Group

Inmac, a major mail-order computer-supply house, has the proper null modem adapter for this printer.

The Emulation Interface Command Set Manual includes a listing of printer commands with short explanations and a section covering serial communications. I'd heartily recommend that you purchase an additional book on using the Laserjet (not the Hewlett-Packard documentation) if that's the emulation you choose.

Once the printer is set up to listen to your PC, it should act just like the machine it is supposed to emulate. Since we had no cartridges for the LaserTEN, we couldn't test how it handles fonts. The LaserTEN did, however, pass our tests for Hewlett-Packard Laserjet text and graphics compatibility.

Despite the unnecessary computer interface aggravation, the LaserTEN is worthy of your careful consideration. It's almost one-third faster than most other laser printers, and it can emulate several printers. The LaserTEN is not the least-expensive laser printer available, but it has some very nice features including an emphasis on user maintenance. Once the LaserTEN is installed, it performs very well.

—Bruce Brown

Cordata LP300 Desktop Printshop

The Cordata LP300 Desktop Printshop takes an unusual and interesting approach to laser printing. Although theoretically appealing, the approach has some real deficiencies in Cordata's implementation.

Most laser printers connect to the PC through the standard parallel or serial connector. The printer itself includes the software to respond to control sequences and compose the page. Fonts are either encoded in ROM within the printer, supplied through plug-in cartridges, or downloaded from the PC. The LP300, however, comes with its own interface board and connector capable of a 1.89-megabit-per-second transfer rate. It needs this speed because the composition is handled within the PC by dedicated software, not within the printer. Before using the printer, you must load a TSR (Terminate-and-Stay-Resident) program that in the default configura-

tion takes up 112K bytes of your PC's memory. (You can increase or decrease this amount by command line parameters.)

All LP300 fonts are stored in files kept on your PC disk. When you print something, the resident program retrieves the necessary font files from the disk, composes the page, and sends the dot patterns to the printer. During the 5 or so seconds required for this process, a message flashes up to the screen that says, "Laser printer active, please wait." One advantage of this method is that Cordata can continually upgrade or change the printer software, which is provided on disk like any other PC program. It could even, for instance, create a PostScript implementation for the LP300. (No, it hasn't and has no plans to.)

The disadvantages of this design for normal printer use are pretty obvious. Not only must you sacrifice an expansion slot and a hunk of PC memory to control the LP300, but you can't do background print-

ing effectively. The cable between the interface board and the printer won't plug into a hardware print buffer. Even if you have a software print buffer or use the DOS PRINT program, the resident program kicks into action before each page is printed and flashes the message on your screen. During this time your PC is locked and unusable. You'll grow to view that "Laser printer active, please wait" message with about as much love as an "Abort, Retry, Ignore" message.

The supplied LP300 software uses English-like ASCII formatting commands (for instance, @ULON to turn on underlining) that you can embed into your word processing documents. Some simple straight-line- and box-drawing commands are also provided. You can define shorter control character macros for combinations of control words.

A supplied file uses these macros to program the software to emulate the Epson MX series control sequences. Each print style (italics, compressed, double width, and bold) requires a different font that the resident program must fetch from the disk during page composition. This Epson emulation has some problems. A normal Epson (or IBM) dot matrix printer can combine double-width and compressed print modes for an 8½-character-per-inch typeface. But since Cordata's Epson emulation simply switches to a different font for the double-width and compressed modes, only the last initiated control sequence will be in effect. The high-resolution graphics mode is also faulty.

Because all the fonts are stored in disk files, the resident page composition software has immediate access to them without the nuisance of changing font cartridges manually. (On the other hand, this is one of the few printers that could be categorized as a "hard-disk-recommended" peripheral.) Cordata supplies about 45 fonts in a variety of styles and sizes. Strangely absent, however, is a normal 10-cpi monospace font. The default font, which is also the font used for Epson emulation, is 12½ cpi. This font could be stretched out to 10 cpi by a control sequence that inserts slivers of space between the letters, but it ends up looking emaciated and it can't print a full 80 characters across the page. Only one of these



Cordata LP300 Desktop Printshop

Cordata Inc.
275 E. Hillcrest Dr.
Thousand Oaks, CA 91360
(805) 495-5800
List Price: \$2,995
Dimensions (HWD): 11.4×18.5×16.3 in.
Weight: 55 lbs.
Made in U.S.A.

In Short: A laser printer that moves page-composition software out of the printer and into the PC and has the potential—unfortunately, as yet unfulfilled—of being many different printers using the same hardware.

CIRCLE 673 ON READER SERVICE CARD

Does your laser printer have enough power to produce a stunning document?

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Armed with Fancy Word, Fancy Font or Laser Fonts your laser printer becomes a high-quality alternative to expensive, time consuming typesetting services. SoftCraft products maximize your laser printer's potential by easily turning your newsletters, presentation materials, documents and invitations into works of art.

In fact, this ad copy was printed using Laser Fonts on an HP LaserJet printer!

1. Font Variety

SoftCraft's complete library contains hundreds of fonts in various styles and sizes from 4 to 72 points. Each product comes with fonts in sizes from 8 to 24 points, including Roman, Sans Serif, *Italic*, Bold, *Script*, Old English and more.

2. Formatting Power

In addition to all of the conventional formatting commands, *Fancy Font* includes commands that deal with variable-width (proportional) fonts and different height fonts. This is especially useful in setting tables, math formulas and perfectly justified text.

Fancy Word and *Laser Fonts* support all of Microsoft Word's formatting features; no other codes or commands are required.

3. Create Custom Symbols and New Fonts

An included font editing program (optional with *Fancy Word*) allows you to modify any character and create new characters and

logos, up to one inch by one inch. You can also create new fonts, scaled to size, from our database of character outlines.

Choose the Product That's Right For You

Fancy Font: A powerful text formatting and printing program that works with any word processor to provide a wide range of font styles and sizes. You embed simple commands in your document to control *Fancy Font*'s extensive formatting capabilities.

Fancy Word: For Microsoft Word users. You use Microsoft Word like you always have, including the paragraph and character format commands, but you now print all the special characters, styles and sizes.

Laser Fonts: Downloads a large variety of fonts, up to 30 points in size, into laser printers at a significantly reduced price over HP. *Laser Fonts* automatically configures Microsoft Word to fully take advantage of the downloaded fonts and can be used with any other word processor that can access soft fonts. *Laser Fonts* can also be used with *Fancy Font* or *Fancy Word* to dramatically speed printing on laser printers.

SoftCraft software runs on PC DOS and MSDOS computers with HP, Canon, NCR, Tall Tree and compatible laser printers (*Laser Fonts* requires a printer with download capability). *Fancy Font* and *Fancy Word* are also available for dot matrix printers.

Call TOLL FREE (800) 351-0500

Please send me information on the following SoftCraft products:

- ☐ Laser Fonts
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PHONE _____

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SoftCraft, Inc., 222 State St., Madison, WI 53703

 **SoftCraft, Inc.**

222 State Street, Madison, WI 53703 (608) 257-3300

CIRCLE 112 ON READER SERVICE CARD

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fonts—a compressed 18½-cpi font—including the IBM high-order character set.

This lack of support for the IBM extended character set is even odder when you consider that the LP300 cannot be used on anything but an IBM PC or compatible since it relies on the TSR-resident software to do the page composition. The software requires DOS 2.0 or later.

One of the best features of the LP300 is its ability to handle bit-mapped graphics images. Any existing software that creates a bit-mapped graphic image in the PC's memory can easily send this image to the LP300 with a single command sequence that specifies the memory address of the image, the size of the image, and where it should go on the page. Thus a graphics screen dump—missing from some laser printers—is simple. This printer may therefore have great value for scientific, optical, or digital processing applications that already work with bit-mapped data and must print it. You may also find that some paint programs may also adapt quite well to the LP300.

The Cordata LP300X may also be helpful for these graphics jobs. The LP300X uses the same printer as the LP300 (the Canon print engine common to many other laser printers) but includes a different interface board with 1.25 megabytes of memory, enough to store a full legal-size page. Programs can directly write bit patterns into this memory and then print them. The LP300X is available for \$3,895 or as a \$900 upgrade to the LP300.

What bothers me most about the LP300 is the potential that Cordata has yet to exploit. I originally looked at the LP300 9 months prior to testing it for this printer project. During that time Cordata could have significantly improved the LP300 simply by upgrading the PC software. It could have developed software that does a better Epson emulation, or a Diablo emulation, or even PostScript. However, the most recent LP300 software I looked at was essentially the same as that of 9 months ago.

By relying on PC software and the overworked 8088 and 80286 to do page composition, the LP300 is bucking industry trends. The trend is towards implementing high-level page composition languages (such as PostScript) in the guts of

the printer, where dedicated high-speed microprocessors and memory can do all the dirty work.

I wish that the LP300's implementation could have justified its different and potentially valuable approach.

—Charles Petzold

DEC LN03

Digital Equipment Corp.'s latest entry in its campaign to keep its foot in the door with micros and peripherals is the DEC LN03 laser printer, which exhibits many of the same characteristics as the company's other micro products: expert technical design that displays nearly total disregard for established standards.

The LN03 starts with the Ricoh laser page printer engine. Like the Canon engine that started the low-price laser printer revolution, the Ricoh is the foundation of many printers (Quadram and AST, for ex-

ample). Like the Canon, the Ricoh is rated at 8 pages per minute, with a 300 dot-per-inch resolution. But there's where the likeness between the two engines stops.

The Ricoh-based LN03 has a 250-sheet input bin and stacks its output facedown so that your reports come out in correct order (faceup printers like those based on the Canon engine stack their output in reverse order). The Ricoh is designed for up to 10,000 pages per month, more than the Canon is designed for.

Also unlike the Canon, the Ricoh has separate toner and photosensitive drum. Operating costs are, therefore, potentially lower since you do not have to replace the expensive drum every time you run out of toner. On the other hand, maintenance is a little more complex, and there's no easy way to remove the toner if you need to ship the printer after it has been set up. The photosensitive drum is in fact a flexible belt, arranged in such a way that the normal paper path is shorter and less tortuous, and, since there's no "straight through" path as on the Canon, running extra-heavy paper through the LN03 may cause problems. DEC recommends a maximum 24-pound stock paper weight. One final difference at the engine level: the Ricoh can draw as much as 950 watts, equivalent to a household of 60-watt light bulbs. Plan on plenty of ventilation and a good power supply.

The controller governs the details that distinguish different manufacturers' printers based on the same print engine. Some controllers make the printer easier to use by providing emulation of other standard daisy wheel or dot matrix printers (often Diablo 630 and the Epson FX-80 series). DEC, however, has built its own set, documented in a 200-page programmer reference manual and summarized in a 14-panel reference card. With plenty of time, patience, and *SideKick's* ASCII conversion table, a technically astute user should be able to get the hang of the command system, but the so-called mnemonic terms such as DECSLPP and DECAWM (lines per page and auto-wrap, respectively) are hard to grasp. These then are expressed in terms of commands that often start with CSI or DCS, which you can look up and find to be "*/11" and "*/10," corresponding to columns and rows on an ASCII table, which you could translate to hex values of



DEC LN03

Digital Equipment Corp.

129 Parker St.

Maynard, MA 01754-2198

(617) 897-5111

List Price: \$3,495

Dimensions (HWD): 15×21×23.5 in.

Weight: 80 lbs.

Made in Japan

In Short: A typical 8-page-per-minute laser page printer that relies on DEC's own peculiar command language, limiting its applicability to only those programs that support the command set.

CIRCLE 675 ON READER SERVICE CARD

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time offer!**
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and save \$30!

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Written using 4th generation language	NO	YES
Source code included/modifiable	NO	YES
Easy-to-change file structures	NO	YES
Report generator	NO	YES
Multi-user option available	NO	YES
On-line help messages	NO	YES
3-yrs. G/L data by month	NO	YES
Create mail/merge files	NO	YES

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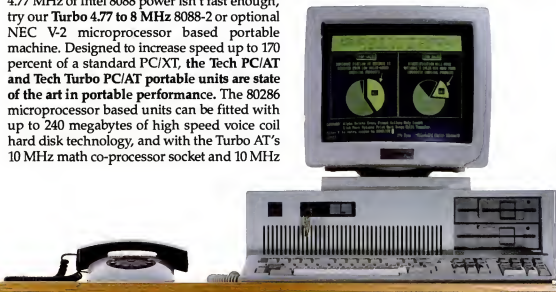
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98 and 90 and then to decimal ASCII 155 and 144, respectively. Or you could find the note about 7-bit and 8-bit commands and discover that these two commands are equivalent to ESC (ASCII 27) and ESC P (ASCII 33) and "1/11 3/11" and "1/11 5/11" respectively). Each command must be issued separately; you cannot string similar parameters together as with the Laserjet. Some relatively simple command sequences can run into long strings before you're done.

Fonts are one area where the LN03 does well. It comes with four font styles, including 10- and 12-pitch.

The command language would probably not be so difficult if it were better documented. No examples appear in the main section of the programmer's reference; tucked into a back appendix is a section entitled "Helpful Hints, Problems and Solutions, and Programming Examples," which contains the only examples, and this section is not a model of clarity or friendly design, either.

According to a DEC representative, most users should not have a problem with the command sequences, since many of the top-selling programs already contain drivers for the LN03—*WordStar 2000* and *Microsoft Word*, for example. If you're considering the LN03, you should take the time to contact the publishers of your favorite programs; see if they support the LN03 and to what extent. Unless you are patient and clever, you are unlikely to get access to the printer's good-looking fonts any other way.

Fonts are one area where the LN03 does well. It comes with four font styles built in, including both 10- and 12-pitch fonts, but no proportional or compressed fonts. Two external slots are provided for ROM or RAM pucks. ROM cartridges can provide

more fonts. A RAM cartridge can add 128K bytes of space for downloaded fonts.

Setting up the LN03 printer was relatively easy—on a par with installing other laser printers. The printer came with everything except the cable and font pucks. When the machine initially failed its power-up test, I found that DEC now has an efficient, courteous, and competent toll-free technical support service. The technician and I went through everything and diagnosed the problem as a faulty micro switch. I discovered that I had failed to remove a small piece of packing tape, and then everything worked fine. Still, DEC's technical support was probably the best of any of the printers I tested for this round of PC Magazine Labs printer tests.

The separate toner is a little messier to handle than in the Canon system, and I found the instructions for installing the photosensitive belt somewhat confusing. Once everything was properly in place, I was able to print the Summary Sheet printed after each self-test, which shows such valuable information as switch settings and their meanings, and samples of all available fonts. All I had to do to set up the printer for use with the PC was change two switches to set the serial interface for 9,600 baud. I used a DEC-supplied cable to attach to the PC, used the DOS MODE command to set the COM1 port parameters and to redirect LPT1 to the COM1 serial port, and I was ready to go. Everything ran as expected, including screen dumps. None of the fonts is compatible with the IBM PC higher-order graphics; so I could not get accurate dumps of screens that used those characters.

The printer performed as expected in the PC Labs tests, turning out 7.4 pages per minute. Since the LN03 doesn't emulate any other printers and we did not have a driver for it, I was not able to test its bit-mapped graphics. According to DEC, it can print up to a half-page at 300 dots per inch. Its cartridge-supplied Times Roman font was attractive (at least as nice as the Laserjet fonts).

Overall, I rate the LN03 as having somewhat lower value than its competition. Since the LN03 relies on its own command language, you must make certain that the software you want to use will support the printer's features. If the LN03

fails to gain widespread acceptance, you might end up with a printer with plenty of potential but limited deliverable capabilities. Emulation could help, but until then, the LN03 costs more than many other 8-ppm printers without giving you much more than fast, quiet line printing.

—Alfred Poor

CIE LIPS 10

The CIE LIPS 10 has two features that make it unique: its Konica engine and its front panel. Without them, the LIPS 10 is simply a very good laser printer; with them, it's a winner. Other laser printers emulate the Diablo, Hewlett-Packard Laserjet, and Epson printers. A few even offer a variety of font technologies and a proprietary programming language. But the LIPS 10 gives you more than lip service; it's the only laser that offers flexibility, outstanding print quality, and an excellent front panel for controlling features—for under \$4,000.

The overall design of the LIPS 10—from its copy-machine appearance to the convenient internal location of the toner bin—is a dream. Although it has only one paper cassette, you can easily slide a sheet of letterhead into the cassette without removing the rest of your paper.

Installing the LIPS 10 is as easy as installing a dot matrix printer; you connect the cable and flip a switch. The printer immediately spews out status sheets that delineate the current settings. If you need to change anything from page layout through emulation to buffer sizes and number of copies, you simply follow the prompts on the legible LCD screen and select the appropriate setting from the front panel.

According to CIE Terminals, the Konica-based LIPS 10 is capable of printing 10 pages per minute; the PC Magazine Labs tests rate it at 8 3/4 ppm in default mode and only a little slower when using a print enhancement such as boldface.

The LIPS 10's ability to flawlessly emulate the Epson, the Diablo, and the Hewlett-Packard Laserjet enhances its worth to those who need a hassle-free printer. I never had a problem with any of the emulations, and in all cases—including the HP Laserjet—the text- and graphics-quality tests produced better print than

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720(h) x 350(v)

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Picture

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Input

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Switch

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(RGB/amber/green)



CASPER GM-1230

Display

Monochrome
18.432 KHz
1000(h) x 350(v)
High resolution

Picture

Non-glare 12" CRT

Input

TTL signal

Dimensions/Weight

320 x 324 x 345 mm
Net wt: 7.8 kgs



CASPER GM-1000

Display

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Picture

Non-glare 12" CRT

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even that of the emulated printer.

Especially noteworthy is the Epson emulation. Because the LIPS 10 emulates the control sequences only, you do not get the dot matrix look of some of the other lasers that emulate Epsoms. The Laserjet emulation is equally impressive; it gives you the equivalent of a Laserjet with a font cartridge. You can implement stroke weight and italic escape code sequences without worrying about which fonts are on-line. Also, the graphics test showed that while the LIPS 10 emulates the HP's poor handling of mixed text and graphics, the output was sharper and darker. (A spokesman for CIE said that as soon as the printer's designers redesign the controller card to hold more memory, you will be able to download HP soft fonts.) The Diablo emulation works just as you would expect, with only a slight difference between the double-strike and the bold enhancement and the use of the change-to-red-ribbon

command as a means of alternating fonts.

The LIPS 10 also comes with a language that allows you to draw such graphics as boxes, pies, and bar codes, and manipulate both the default fonts and the set of CIEFLEX fonts, which are stored as vectors. The CIEFLEX font technology, which CIE bought from Oasys, allows you to generate new fonts simply by changing some parameters. (For a more detailed description of the language, see the Oasys LaserPro 810-R review in this issue.)

Laser printers have traditionally been thought of as either glorified daisy wheels or complicated pieces of electronics. The LIPS 10 is the first laser that enables you to use all its features simply and elegantly. My only complaint is that I don't currently own one. —**Vincent Puglia**

LaserImage 2000

The LaserImage 2000, a recently released laser printer from Personal Computer Products, is based on the 8-page-per-minute Ricoh engine. Weighing in at over 80 pounds, the LaserImage 2000 is no lightweight—the manual even includes a warning that it takes two people to remove it from the box.

Neither is the LaserImage 2000 a lightweight in power. It comes equipped with 1.5 megabytes of RAM, enough to generate an impressive full page of graphics at 300 dots per inch. Should your thirst for graphics, fonts, and software emulation make a mere 1.5 megabytes seem limited, you can add another 512K bytes to bring it up to a full 2 megabytes (now you know why they call it the LaserImage 2000).

Preparing the LaserImage 2000 for first-time use is simple: the only trick is to install the organic photoconductor belt cartridge (which functions in the capacity of a drum) within 5 minutes of removing it from its package. Fill the toner cartridge, pop in the 250-sheet paper bin, and you're off. Unlike Canon-engine-based laser printers like the Hewlett-Packard Laserjet, this Ricoh machine packages its image-tracing surface (the organic photon controller belt, in this case) and toner separately so that they can be replaced independently of one another (although the frequency with which you must do so means you'll spend slightly more on main-

tenance than you would with an HP Laserjet).

The LaserImage's control panel offers only brief messages, and so you may need to refer to the manual to interpret them. You'll also have to refer to disk-based programs to perform certain operations you might expect to perform from the control panel, such as changing among the resident software emulations. In its tested version, the printer offered only Diablo 630 emulation and a subset of Hewlett-Packard Graphics Language (which allows the printer to run drivers written for the HP 7470 and 7475A plotters).

Unfortunately, I was unable to test the printer's graphics capabilities for two reasons: the PC Magazine Labs benchmark tests don't include drivers for those plotters, and the beta version of the printer's forthcoming Epson emulation software failed to load. Before buying the LaserImage, to do graphics, make sure your application has the proper drivers.

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PC MAGAZINE EDITOR'S CHOICE FACT FILE



CIE LIPS 10

CIE Terminals & C. Itoh Electronics Inc.
2505 McCabe Way
Irvine, CA 92714-0315
(800) 854-3322
(714) 660-1421 (in Calif.)

List Price: \$3,495; starter kit that includes cassette, manuals, drum, toner, and so on, \$299

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Weight: 82 lbs.
Made in Japan

In Short: A laser printer able to generate fonts and equipped with a friendly front panel; it's going to change how people perceive laser printers.

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PC MAGAZINE FACT FILE



LaserImage 2000

Personal Computer Products Inc.
11590 W. Bernardo Ct., #100
San Diego, CA 92127
(619) 485-8411

List Price: \$3,495

Dimensions (HWD): 13×21×16 in.
Weight: 80 lbs.

Made in Japan and U.S.A.

In Short: A laser printer offering full-page 300-dot-per-inch printing—aluring for the price but lacking sufficient software at present to put its capability to work.

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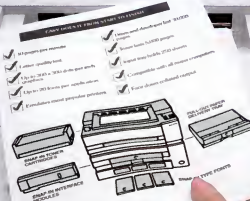
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to us) were a cartridge-based Epson MX, FX, and IBM 5152 Graphics Printer emulation to be supplied with the printer, and an optional (\$295) HP LaserJet Plus emulation cartridge. According to Personal Computer Products, the latter will be compatible with the HP Soft Font Library.

The LaserImage 2000's resident 10-pitch Courier character set is slightly narrower than I'd like. Especially when compared to the well-formed TI OmniiLaser 2015 font, the LaserImage 2000's print has a less robust appearance.

The printer performed well in Diablo 630 mode when I entered control codes from the keyboard, but it strangely failed to boldface a test line in the Diablo 630-compatibility test (in all other respects, Diablo 630 compatibility worked flawlessly). The resident character set includes some, but not all, of the IBM graphics characters: the LaserImage 2000 excludes ASCII characters 224 and higher.

The LaserImage 2000's 8-ppm throughput figure tested at 7.45 ppm in the PC Labs test, a respectable 93 percent of its factory rating.

The LaserImage 2000 is one of the new breed of laser printers being developed in response to the rapid growth in the laser printer marketplace; so new in fact, that the documentation I received was as yet unbound. Unfortunately, much of the requisite laser paraphernalia I would expect to see—font cartridges and software emulation modes—had yet to be released when I tested the machine. At this point the printer's newness and these unknown factors may be its greatest handicap.

If Personal Computer Products delivers the font cartridges and software emulation modes in good shape, the \$3,495, 1.5-megabyte LaserImage 2000 (just \$500 more than the 128K-byte HP LaserJet and \$500 less than the 512K-byte HP LaserJet Plus) promises to offer quite a lot for its price. —Richard W. Riddington, Jr.

QuadLaser

The trouble with buying a brand-new laser printer is that you usually can't find software that has the necessary printer drivers to take advantage of its incredible capabilities. That's why Quadram Corp. saw fit to release four printers in one. First and fore-

most, it's a QuadLaser, with some features not found on other printers. But second, third, and fourth, this printer can emulate a Qume, an Epson, or the Hewlett-Packard LaserJet.

So, on the plus side, you can use the QuadLaser with virtually any software package. On the other hand, when Quadram says emulation, it means emulation; the QuadLaser emulates the other printers exactly. In Epson mode, for example, this \$3,795 laser printer gives you clean, crisp dot matrix print!

The QuadLaser is based on a Ricoh print engine that was designed to support heavy use, up to 10,000 photocopies per month. Its rated speed of 8 pages per minute is only slightly exaggerated. It yields about the same throughput as the HP LaserJet, which printed at 7.36 ppm in the PC Magazine Labs speed test. But the QuadLaser beats the LaserJet on features such as full-page 300-dot-per-inch graph-

ics and an internal memory of 1.5 megabytes (expandable to 2 megabytes) that can store up to 60 fonts on-line simultaneously. So what if there are no expensive plug-in font cartridges; you just download the fonts from a library font disk or, if you like, use the QuadLaser software to create your own fonts.

The printer's operations manual, along with the separate installation manual, provides clear, well-written, step-by-step instructions on how to set up the printer. The manual even provides instructions for unpacking the box. But I wish it discussed the finer points of the printer's features, such as mixing text and 300-dpi graphics, in more detail.

You can press the self-test button on the rear of the printer to find out immediately whether or not the printer operates correctly. The self-test also tells you the amount of the laser's memory currently occupied by downloaded fonts, the current emulation mode, the interface being used, and the names and code numbers of all the available fonts.

The QuadLaser comes with several useful programs on disk, including one of the best menu systems I've ever seen. Although the documentation does not describe these programs adequately, the programs are so easy to use that they don't need detailed explanations. The printer-control menu allows you to select such features as portrait versus landscape orientation, horizontal and vertical spacing, and the printer emulation modes. A font-selection menu lets you select fonts by highlighting their names with a bar cursor. The menu also gives you control over the four margin settings.

QuadLaser also includes the ultra-useful *FormTool* software program. It lets you quickly custom design and alter any business forms that can be created out of alphanumeric and graphics characters, in effect turning the printer into a veritable business-forms generator.

The menu programs for controlling the printer's fonts and features, the ability to quickly download multiple fonts, the full-page 300-dpi graphics—for me, it all boils down to one simple fact: I own an HP LaserJet Plus, and while it has been a superb printer, I now wish I owned a QuadLaser instead. —Phil Wiswell



QuadLaser

Quadram Corp.
One Quad Way
Norcross, GA 30093-2919
(404) 923-6666
List Price: \$3,795
Dimensions (HWD): 13×20×16.5 in.
Weight: 81.6 lbs.
Made in U.S.A.

In Short: An easy-to-use laser printer that emulates a Qume, an Epson, and the Hewlett-Packard LaserJet, with menus to control features and fonts, full-page 300-dpi graphics, 1.5 megabytes of memory, and speed that rivals the HP LaserJet.

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QMS ConceptWriter

The QMS ConceptWriter offers four emulations (VDI/ANSI, Diablo, Tektronix, and bit image), menu-driven software for selecting features, and a fairly extensive set of graphics commands. This laser printer is also designed to be interfaced to QMS's Concept 100 desktop publishing system. Because of this last feature, the ConceptWriter may be less desirable than other laser printers.

As you would expect of a Canon-engineered-based laser, the appearance of the ConceptWriter resembles the Hewlett-Packard LaserJet minus the font cartridge slot. The paper cassette, which holds approximately 100 sheets, lies just below the paper tray. A manual-feed tray is located in the back. One nice feature is an intelligent port that automatically configures itself as either a serial or a parallel port; both cables are supplied with the unit.

The menu software provides foolproof

access to printer initialization, allowing you to select such options as emulation, font, and pitch with the cursor keys. As convenient as the menu is, though, the disk PC Magazine Labs received for review required rewriting the batch file so that it would create the proper subdirectories and transfer only those programs needed for the standalone printer. Also, rather than amend your AUTOEXEC.BAT and CONFIG.SYS files, the batch program replaces them, sending all your carefully planned setup off to oblivion. If you intend to use escape code sequences rather than the menu, you need to wade through the documentation. Rather than set off the escape code sequences, the manual places them right in the midst of the rest of the text so that they are easily lost.

While many software packages support Diablo, ConceptWriter's "emulation" of that printer may not be what a program expects. It does not support commands for bold and shadow enhancements, and it has problems recognizing form-feeds embedded in a *Microsoft Word* document. Its other emulations, however, appear to be on more solid ground. The VDI/ANSI emulation, for example, supplies commands for drawing graphics and manipulating text. In addition to being able to draw such primitive building blocks as bars, pies, arcs, and polygons, you can manipulate attributes such as fill and background. You can also specify such text attributes as position, font and size, overstrike, underline, and string length.

During one of my many calls to QMS, I was informed by one of the technical support staff that they do not support the ConceptWriter. Rather, a separate section consisting of two people furnish all of the support: one of them was out of town when I called, and the other could not explain why the Diablo emulation did not recognize the form-feeds or help me with the control code sequences.

My biggest complaint about the printer, though, is its speed. At 2.96 pages per minute, the ConceptWriter is little better than a daisy wheel—and much more expensive—if you're using it for text. It may offer unparalleled desktop publishing features when sold with the Concept 100 system, but it isn't up to par as a standalone printer. —**Vincent Puglia**

AST TurboLaser

The AST TurboLaser is a comprehensive printing system. You need to give up a slot in your computer for the interface card and may find the learning curve a bit steep, but successful implementation of the TurboLaser will yield a versatile printer with a host of fonts, pitches, and printer emulations. One of the best features of the system is very readable documentation.

The TurboLaser is based on an 8-page-per-minute Ricoh-engine laser printer. It includes an interface card that fits in an 8-bit slot in a PC AT or compatible. The interface card and the included cable are all the hardware you need to make the computer and printer communicate.

The card includes 1.5 megabytes of memory into which you load the AST Laser Language (a proprietary page description language), the desired emulation program, and as many fonts as will fit. The software is included on seven disks.



FACT FILE



QMS ConceptWriter

QMS Inc.
P.O. Box 81250
Mobile, AL 36689
(205) 633-4300
List Price: \$4,495
Dimensions (HWD): 11.4×18.7×16.3 in.
Weight: 55 lbs.
Made in Japan

In Short: An excellent laser printer when combined with QMS's desktop publishing system, but one that leaves much to be desired as a standalone.

CIRCLE 636 ON READER SERVICE CARD



FACT FILE



AST TurboLaser

AST Research Inc.
2121 Alton Ave.
Irvine, CA 92714
(714) 863-1333
List Price: \$4,995
Dimensions (HWD): 13×20.9×16.5 in.
Weight: 81.5 lbs.
Made in Japan (controller in U.S.A.)

In Short: A powerful printing system that includes a printer, an interface and memory card, and a selection of fonts and emulation modes as well as a proprietary laser language.

CIRCLE 637 ON READER SERVICE CARD

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*PC WORLD Magazine's 1986 World Class Survey.



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CIRCLE 199 ON READER SERVICE CARD

Installation and familiarization with the AST TurboLaser is at least a half-day's job, more likely a full day's. You have to be careful or you will get toner on your hands and clothes. You have to put the TurboLaser's pieces together yourself—probably a good idea, because you'll learn enough to do some service or troubleshooting later. The parts fit together easily, but you have to be careful. The OPC (organic photo conductor) cartridge, for example, is light sensitive and can be exposed to light for only 5 minutes without jeopardizing the quality of images produced.

The only problem I had in setting up the AST was with the development drawer. I went through the whole installation routine and could not get the printer to self-test. The control panel error code display indicated an open cover. I could find nothing wrong and went through the drill again. Finally, I asked someone else in the PC Magazine Labs for help. He said that Ricoh-engine printers often have a problem with the development drawer cover. He gave a sharp rap to the development drawer, the error signal went out, and everything was fine after that.

In addition to unpacking and assembling several parts on the printer itself, you have to configure and install a full-length circuit board in your computer. The printer comes with its own required software. A hard disk is recommended to store the seven disks' worth of language and font files.

Every time you intend to print using the TurboLaser, you must load the printer's language program, a 233K-byte program. Fortunately, the language program and any fonts you wish to have resident are all loaded in memory on the AST circuit board, which serves the dual purpose of printer interface and printer memory card.

Approximately 240K bytes is allotted for loading fonts. If you do not load any fonts, the printer defaults to Courier 12. In addition to the Laser Language and fonts, you also load an emulation program. The choices are the Epson FX in either Epson or IBM mode, Diablo 630, Hewlett-Packard 7475A plotter, or Laser Language emulation. The default emulation mode is Diablo 630.

All this hardware and software may sound fascinating or terrifying, but they must interact properly to make your word

processor, spreadsheet program, or database management system work with the TurboLaser. To facilitate the process, AST has included header files you send to the printer prior to file or document printing that will tell the TurboLaser what printer or mode to emulate. Once you become more familiar with the system, you can alter the header files to have more direct control of your computer, applications software, and the TurboLaser.

The manual includes an explanation and examples for loading the laser language, fonts, and emulation language using reasonably simple DOS batch files. I eventually wrote a series of batch file menus to simplify the steps—a good idea for those who can do it. In general, the TurboLaser requires a good deal of effort to get working and to master.

The printer offers four fonts: Courier, Letter Gothic, Dutch, and Swiss. There are 25 point sizes among the various fonts, and each font and point size can be printed in both portrait and landscape orientation, making the number of standard characters possible total 50! Typical applications programs can call only a couple of fonts if they can even call more than one, so much of this flexibility is somewhat moot, but by sending headers to the printer you can control the font, pitch, and orientation independently of your applications program, unless it's a program, such as *Enable*, that takes over the printer and resets everything to its own liking.

The TurboLaser comes with super documentation. Not only is the operations manual helpful for installing the printer and setting up for initial operation, it also is well written. Laser printer programming is a world of its own, but the manual for the TurboLaser actually makes sense.

The base model is not totally IBM PC compatible. The TurboLaser requires the international character set to create the IBM higher-order character set. This international set is optional.

At \$4,995, the TurboLaser may be overpriced for the user who just wants a laser printer to print nice-looking letters and documents. But if the TurboLaser's emulations, fonts, and Laser Language meet your needs, AST's reputation of building quality hardware underscores the potential value of this system. —Bruce Brown

HP Laserjet 500 Plus

A Hewlett-Packard laser printer has three things going for it: a Canon engine, font cartridges, and its role as a laserprinter standard. Of the three, only the first two are truly assets. For despite the popular perception of the Hewlett-Packard Laserjet 500 Plus as a giant among lasers, it generally functions as if it were no more than an expensive, relatively fast and flexible daisy wheel printer with a two-tray paper-feed system.

Connecting the Laserjet 500 Plus to the IBM PC's parallel port is relatively easy—after you realize that the printer is initially set up for serial mode and that the instructions for reconfiguring it are not in the installation section of the operator reference



HP Laserjet 500 Plus

Hewlett-Packard Co.
3000 Hanover St.
Palo Alto, CA 94304
(800) FOR HP
(415) 857-1510

List Price: \$4,995; \$225 to \$400 per font cartridge; \$115, toner cartridge; \$79, HP PCLpak; \$200, Soft Font package

Dimension (HWD): 18.1 x 18.5 x 34.4 in. (with trays); 19.5 x 18.5 x 34.4 in. (without trays)

Weight: 94 lbs.

Made in Japan

In Short: An oversized, overglorified, hard-to-use laser printer based on a Canon laser engine.

CIRCLE 63 ON READER SERVICE CARD

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CIRCLE 215 ON READER SERVICE CARD



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Access Speed

The Express Hard DiskCards, with an average access speed of 60 msec, gives you—in addition to that extra speed—head retraction. Before you start thinking you've just got to have head retraction, you should

know that the 80 msec Express Hard DiskCards are rated at 50 g's power off and 10 g's power on. Furthermore, our 80 msec Hard DiskCards, like all Express Hard DiskCards, have plated media. Most hard disks-on-a-card have iron oxide (it looks and acts like rust), which means if the head hits the iron oxide, it will gouge out media and your data along with it. Plated media, on the other hand, looks like a car's chrome bumper. If the head hits, it will cause little or no damage. That's why Express offers drives with high g tolerances.

All of the benefits of our 80 msec drives aside, you may want to get our 60 msec drive just for the extra speed. But in addition to increased

access speed, you'll be getting automatic head retraction.

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Capacity formatted	20.05MB	20.00MB	20.05MB	30MB	30.08MB	40.00MB	60.16MB
Transfer rate	5Mb/sec	5Mb/sec	5Mb/sec	5Mb/sec	7.5Mb/sec	5Mb/sec	7.5Mb/sec
Avg. access time	60msec	80msec	60msec	80msec	60msec	80msec	60msec
Slots	1½	1½	1½	1½	1½	2	2
Media	Plated	Plated	Plated	Plated	Plated	Plated	Plated
Warranty	1 year	90 days	1 year	1½ years	2 years	2 years	2 years
Head lifter	automatic	manual	automatic	manual	automatic	manual	automatic
Price	\$449	\$495	\$595	\$695	\$795	\$995	\$1,095



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Removable Hard Disk

10	1/2	yes	90 msec	5 Mbits/s	\$1,095	\$1,095
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Tape Systems and Subsystems

Formatted Storage Capacity	Height	Data Transfer Rate (k/sec)	PC or PC/XT	AT
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CIRCLE 380 ON READER SERVICE CARD



LASERS—\$4,995

manual but rather in an appendix to the technical reference manual. The Canon engine means no-mess installation and poses a problem only if you fail to completely remove the plastic separating the drum from the toner.

More so than with any other printer (laser or otherwise), the HP font cartridges are responsible for the Laserjet 500 Plus's output. Without them, it has few enhancements. You can't even access boldface, for example, because it's not one of the available default fonts. True, you can program the Laserjet 500 Plus so that it backspaces to the beginning of the word or phrase and then overstrikes the characters (the method used by *WordStar*, Version 3.31, and other applications), but that means you have to learn HP's language first.

And what Hewlett-Packard calls an escape code sequence resembles the chemical formula for an organic compound more than it does the simple sequences other printers use. In fact, if you combine some of the codes, you select fonts with from 30 to 45 characters. Fortunately, many applications packages that offer printer drivers have already included a Laserjet option; so you won't have to learn any of the codes if you intend to use it with one of them.

In addition to the font cartridges, you can purchase a *Soft Font* package that adds even more enhancements to the Laserjet. While the package includes a utility that downloads the fonts to the printer, you'll probably also want to buy the *HP PCLPak*, which includes a more robust utility as well as a means of formatting and printing relatively simple documents.

Interestingly enough, the PC Magazine Labs graphics test showed that the Laserjet 500 Plus has trouble printing graphics and text at the same time. Evidently, the printer loses track of the cursor's coordinates when switching from one mode to the other. If you need to mix the two modes, you must reset the coordinates after each mode switch—not what you'd call an elegant solution.

If I've ever seen a product in need of documentation, it's the Laserjet 500 Plus. The poor excuses for manuals supplied with the printer are completely obtuse, and their organization is far from logical.

If you've already invested in a huge base of HP font cartridges and would like

to be able to use separate bins for different types of letterheads, you might want to consider purchasing the Laserjet 500 Plus. But even then, you'd probably do better with the Oasys LaserPro 810-R; you won't get the two bins, but you'll get a true laser printer, not something that acts like a daisy wheel but tries to pass for a laser. If this is your first laser purchase, you should consider the CIE LIPS 10. The Laserjet 500 Plus does not sit on top of a pedestal in the laser market; only HP's image makes it look that way. —**Vincent Puglia**

Oasys LaserPro 810-R

The Oasys LaserPro 810-R offers something that many other laser printers do not: immediate functionality coupled with extreme flexibility. In addition to five emulations (Epson, Laserjet Plus, Diablo, NEC Spinwriter 3550, and Qume Sprint), the LaserPro 810-R has a set of standard fonts and software that allow you to generate

new fonts from a set of vector-mapped ones.

The LaserPro 810-R, based on a Ricoh engine (Oasys also sells an 810-C, based on the Canon engine), comes with 1 megabyte of memory. While the unit PC Magazine Labs received for review had slots designed for font cartridges, an Oasys spokesperson says that the cartridges are not yet available. The front-panel display sports icons rather than words, and the legend that translates them is conveniently placed atop the unit.

In all the emulations, the LaserPro 810-R performed at least as well as the original printer, and in some cases it did better. The Epson emulation, for example, lacked the dot matrix look, and the graphics quality was much sharper. The only problem I ran across was with the NEC emulation; *WordStar* could not get the printer to double-strike. The most impressive emulation was of the Hewlett-Packard Laserjet Plus. Not only does the LaserPro 810-R download HP software fonts, but it also allows you to make your fonts boldface without having a bold font in place. The graphics, except for the sharper quality, exactly duplicate those of the Laserjet Plus, complete with its inability to mix text and graphics.

If you don't have the fonts to download, you can always generate your own by altering one of the six mathematical representations built into the system. These fonts and the Express programming language that supports them are the LaserPro 810-R's greatest strength. Generating a font is a relatively simple operation, requiring only that you specify a few parameters, such as the height, x and y axes, boldfacing, and slant for the new typeface. Because the slant parameter decides the font's orientation to the page, you can generate both portrait and landscape fonts, as well as anything in between. Using a generated font is simply a matter of selecting that font as the current one.

The Express language also supports a number of graphics commands for creating pie charts, bar codes, and boxes. You can also create macros, shade specified areas, and position the cursor anywhere on the page.

If the Oasys LaserPro 810-R were a little less expensive and had a control panel



Oasys LaserPro 810-R
Oasys
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San Diego, CA 92111
(800) 732-4589
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Dimensions (HWD): 13×20.9×16.5 in.
Weight: 99 lbs.
Made in Japan
In Short: A laser printer that offers flexibility and functionality by supplying five emulations and an internal set of vector-mapped fonts.
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4-11-88



similar to that of the CIE LIPS 10, it would be the laser printer of choice. As it is, though, the extra emulations warrant the added expense only marginally. If money is no object, though, the Oasys LaserPro 810-R is a fine choice. —**Vincent Puglia**

Xerox 4045 Laser CP

When is a printer not a printer? When it's both a printer and a copier. The Xerox 4045 is an imposing laser printer, compatible with both the Diablo 630 and Xerox 2700, that has a convenient copier option for single-sheet copying. It demands considerable space and electricity. In return you get typically beautiful laser output, relatively easy operation, speedier-than-usual throughput, and the option to use as many as 22 fonts on one page.

You can install up to four font cartridges at one time on the 10-page-per-minute, 300-by-300-dot-per-inch laser printer, in convenient front cartridge slots. Depending on the amount of memory in the cartridge (4K to 64K) and the font type, one cartridge may have only one or several fonts. In addition, Xerox's Corporate Font Center can create customized fonts, artwork, logos, and signatures.

The copier feature, a \$400 option, isn't intended to compete with fancier full-service copiers. A single-sheet, manual-feed copier, it makes one copy at a time. At first I thought the copier option a frill, but in time, I found myself using it frequently rather than getting up and walking across the room to the larger office copier.

The paper-output tray holds up to 100 sheets of legal- or letter-size paper and the paper-input tray holds 250 sheets. The Xerox 4045 is "aware" of its 250-sheet capacity, and when it senses there is not enough imager (toner) to print 250 pages, it will stop and prompt you until imager is added.

Dry imager comes in a bottle good for 6,000 pages. Developer also comes in a bottle, with enough for 40,000 pages. Refilling the imager and toner is not difficult, but this system is less convenient than just replacing a cartridge, as you do with printers based on the Canon laser engine.

The Xerox 4045 looks like a copier adapted to computer printing—it demands a table or stand of its own. Because the

4045 weighs 160 pounds, it will probably stay where it's first put.

The 4045 uses roughly 1,000 watts, which probably means it needs its own circuit.

The 4045 has a power-on self-test that ends by printing a configuration sheet listing switch settings, parameters set, and fonts resident and in cartridges. The DIP switch configuration cartridge plugs into the front of the printer and consists of four sets of eight switches each. This has to be the easiest way ever invented to change DIP switch settings.

The 4045 is rated at 10 pages per minute but actually produces a little over 9. It prints so quietly that the PC Magazine Labs sound meter, which measures as little as only 60 decibels, could not detect any sound during printing.

The Xerox 4045's documentation is complete and effective. Both the operator manual and reference manual are well written. The reference manual has several good examples of programming com-

mands to invoke the printer's features.

Programming the printer to set and use fonts and graphics commands is straightforward but tedious. The 4045 is compatible with the Xerox 2700 laser printer and its page composition and graphics language. While this system is powerful, accepting the language will have to be a significant factor in choosing the 4045 as an office printer.

The standard 4045 will not print the IBM PC high-order character set. According to Xerox, an IBM PC graphics character font cartridge is available, but it was not provided with our review unit. The 4045 passed our tests for both text and graphics compatibility with the Diablo 630.

I had occasion to call Xerox customer support several times for information and assistance. I found the support people knowledgeable and very friendly. Most people who buy 4045s will probably purchase service and support agreements as well, which will entitle them to use this helpful staff.

The Xerox 4045 cannot be considered a simple laser printer; at \$5,000 or more it can't compete with lower-priced brands. This printer makes sense if you already have Xerox 2700s in-house and a purchase agreement with Xerox, and you want to use the 4045 as a lower-level machine.

While the 4045, which can accommodate a long list of software, is a step up from the more-common Canon- and Ricoh-engine laser printers, the step is not enough to justify its higher price and bulk if you're just going to run standard PC software. In sum, it's a fast, very quiet, very large, expensive laser printer with several convenient features but needs to be considered in light of its graphics and page composition language. It's too big to be pretty, but it sure prints nice copy. —**Bruce Brown**

QMS PS-800

Most laser printers are simply very expensive, fast, high-tech versions of daisy wheels; that is, their potential is rarely achieved because they lack an appropriate programming language. An exception to the rule is the QMS PS-800. While it may not be the ideal laser, it does boast one of the most well-thought-out printer languages—Adobe's PostScript. In addition,



Xerox 4045 Laser CP

Xerox Corp.
701 S. Aviation Blvd.
El Segundo, CA 90245

(213) 536-7000

List Price: \$4,995

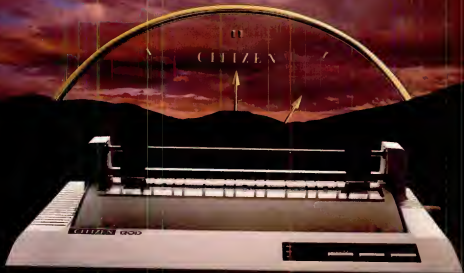
Dimensions (HWD): 10.5×27.5×21.5 in.

Weight: 160 lbs.

Made in U.S.A. (engine made in Japan)

In Short: A hefty printer with a hefty price and features to match, including Diablo 630 and Xerox 2700 compatibility and the ability to act as a single-sheet copier.

CIRCLE 626 ON READER SERVICE CARD



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CLUB GOLF



LASERS—\$5,899–\$5,995

this Canon-engine-based printer emulates the Diablo 630. As a result, you can have both the fastest letter quality printer on the block and a highly versatile printer that will become more useful as time goes on.

Connecting the PS-800 to an IBM PC is not as easy as you may expect because of the lack of a parallel interface. Although the manual mentions its availability and even illustrates a parallel interface, a QMS representative says that only the serial and AppleTalk interfaces are currently available. The installation is further complicated by the fact that QMS does not usually ship cables with its printers. Nor can just any serial cable work; you need to get a specially configured one. The PS-800 shares with Apple's LaserWriter Plus the use of XON/XOFF handshaking through software, and the result is the same—skipped pages. Unfortunately, the PostScript program that enabled the LaserWriter's hardware handshaking did not work on the PS-800. Once the printer is installed, though, things run far more smoothly.



QMS PS-800
QMS
P.O. Box 81250
Mobile, AL 36689
(205) 633-4300

List Price: \$5,899
Dimensions (HWD): 11×18.7×21 in.
Weight: 72 lbs.
Made in Japan

In Short: A Canon-engine-based laser printer that offers Adobe's powerful page description language, PostScript.

CIRCLE #12 ON READER SERVICE CARD

Although the printer comes with Diablo emulation, it is not as robust as you may want. You can, for example, only invoke the boldface enhancement with Diablo's Esc-O sequence. As a result, if your word processor fudges boldface by backspacing and then double-striking, the text will not be affected. Also, because the emulation automatically forces a form-feed after 30 seconds, you cannot echo to the printer and assume the page will wait for the next line of output. On the plus side, the print quality, especially for shadow printing, is excellent.

As noted elsewhere in this issue, Adobe's PostScript may be the answer for a device-independent page-description language. Its interpreter is a full-blown programming language with procedures, arrays, and program control operators such as repeat and if/then/else. It has more than enough commands to support virtually every graphics primitive you will ever need to create, including those to draw a circle, arc, and box.

In addition to the commands for setting up page layouts, there are commands for silhouetting graphics, customizing your own fonts from standard fonts, and creating outlined fonts. About the only drawback to the language that you may run into is that it requires you to spend some time mastering it, but as they say, "There's no such thing as a free lunch."

The documentation for the PostScript language takes up most of the manual's 500-plus pages, with three main sections: Language Manual, Cookbook, and Font Manual (which contains more than 150 pages of font samples). The reference section, located in the first section, is concise and clear, but technical. The Cookbook has enough illustrations, explanations, and programming examples for even the beginning programmer to create and print a quality design.

The QMS PS-800 may not be the printer for everyone (especially at its list price of \$5,899), but it does presage where laser printers are headed. It and the Apple LaserWriter will not be the only two printers to support the PostScript language. By the time you read this, other vendors are certain to have jumped into the fray. The excitement is just beginning.

—Vincent Puglia

TI OmniLaser 2015

Networks and laser printers are a match made in heaven. Not a company to ignore an opportunity, Texas Instruments has aimed its new TI OmniLaser 2015 at network users by giving it a duty cycle (2,500 pages per month) that can easily accommodate the demands of multiple users.

The OmniLaser 2015 is hot new competition for Hewlett-Packard's Laserjet Plus 500: Both printers handle 500 sheets, have 512K bytes of memory, and can print a half-page of graphics at 300 dpi. Although the OmniLaser 2015 commands \$1,000 more, its duty cycle is over four times that of the Laserjet Plus 500. Because the OmniLaser uses a Ricoh, rather than a Canon, print engine, its maintenance costs are lower as well: when a Canon-engine-based laser printer runs out of toner, you must replace both the

PC MAGAZINE FACT FILE

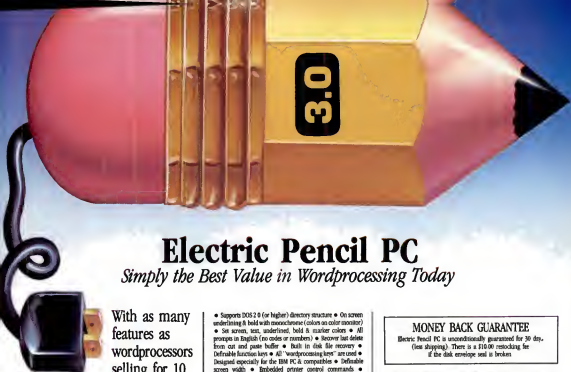


TI OmniLaser 2015
Texas Instruments Inc.
Data Systems Group
P.O. Box 809063
Dallas, TX 75380-9063
(800) 527-3500

List Price: \$5,995
Dimensions (HWD): 17.5×21.5×28.5 in.
Weight: 88 lbs.
Made in Japan

In Short: A laser printer designed for heavy-duty use that generates stunning graphics but is flawed by a faulty HP Laserjet emulation.

CIRCLE #10 ON READER SERVICE CARD



Electric Pencil PC

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times the price, Electric Pencil PC was designed to be sophisticated enough for the professional user yet simple enough for the beginner. Our "Quick Start Guide" will have you writing, editing, and printing in less than 20 minutes. Once you have the basics, any of 500 functions are available with a simple key-stroke. The on-screen help and extensive tutorial windows are like having a manual on disk.

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photoconductor belt and the toner (combined in one unit), but with the Ricoh, you replace just the toner (the photoconductor belt is a separate unit).

The OmniLaser comes with resident software to instruct the printer to feed from bin 2 when bin 1 empties, effectively giving you 500-sheet input capacity. But the only way you can now access the capability is to write a simple BASIC program to do so and load it before you run your applications (as long as your application doesn't reset the printer on startup). An output tray, mounted on the top of the printer, can accommodate all 500 sheets. It also feeds paper facedown to eliminate the need to collate.

The OmniLaser's native character set is typically laser printer perfect; the exceptionally black graphic fills it produces are atypical. Unlike most laser printers (which expose the image portion of the page), the OmniLaser exposes the background to the laser to produce a fill so stunningly black your graphics will be standouts.

The OmniLaser comes standard with a memory-resident arsenal that includes a Courier typeface (Prestige for international versions of the printer); the full IBM 256-character set; 10, 12, or 16.7 pitches; and portrait or landscape orientations. Since they're all resident, you can freely mix typeface, pitch, and orientation for a good array of built-in font options. Two cartridge slots allow you to add several optional fonts and software emulation modes (HP Laserjet Plus, IBM Proprinter, and TI 810).

Using the LCD-equipped control panel, you can select from four software emulation modes: HP Laserjet, Diablo 630, TI 855 WP, and TI 855 DP. But the OmniLaser stumbled badly on the PC Magazine Labs benchmark tests for HP Laserjet graphics emulation; it split images across pages and mixed them with text. Since HP emulation is the primary means through which the OmniLaser can tap its awesome graphics printing potential, it's vital that this problem be resolved soon. TI engineers reported that the Laserjet emulation worked fine with applications software they had tested, and they seemed anxious to correct any problem. The TI 855 DP emulation mode (which in turn emulates an IBM graphics printer) pro-

duced flawless graphics output, but at 120 by 144 dots per inch and with a case of the jaggies.

Although the heavy-duty TI OmniLaser 2015 produces good graphics output, its faulty performance on PC Labs' Laserjet emulation test is a major flaw. Let's hope this problem is fixed soon, for this laser printer has great things to deliver.

—Richard W. Riddington, Jr.

Apple LaserWriter Plus

When you set up the Apple LaserWriter Plus so that the colorful Apple logo beams down on your PC's corporate-gray IBM logo, you're making a definite statement about yourself. You're telling the world that beneath your pinstripes you still retain some countercultural tendencies, that you won't settle for second best when it comes to fonts, that you have seen the future and it is PostScript, and that you can afford a cool six grand for a printer.



Apple LaserWriter Plus

Apple Computer Inc.
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010

List Price: \$5,999; upgrade kit, \$799
Dimensions (HWD): 11.5×18.5×16.2 in.
Weight: 77 lbs.
Made in U.S.A.

In Short: An expensive PostScript-based laser printer that can't do much in Diablo 630 emulation mode but really shines with a program like *Microsoft Word*.

CIRCLE 640 ON READER SERVICE CARD

The LaserWriter Plus is an improved version of the LaserWriter. It's a Canon-engine-based 300-dot-per-inch laser printer with a ripsnorting 12-MHz 68000 processor, 1.5 megabytes of RAM, and 512K bytes of ROM. The ROM contains an interpreter for the PostScript page-description language and a whole bunch of fonts. Aside from the three standard PostScript fonts included in the LaserWriter (Courier, Helvetica, and Times Roman), the LaserWriter Plus adds three fonts licensed from Allied Corp. (a narrow Helvetica, Palatino, and New Century Schoolbook) and three fonts licensed from International Typeface Corp. (Avant Garde, Bookman, and Zapf Chancery). Most of these fonts also include boldface and oblique (or italic) versions.

The Zapf Chancery Italic font is the most distinctive. It looks like calligraphy—perfect for formal invitations. A seventh new "font" is called ITC Zapf Dingbats, a collection of asterisks, daggers, check marks, and bullets. I suspect that desktop publishers will use these dingbats with merry abandon.

Three pages in the LaserWriter Plus manual are devoted to using the printer with something other than a Macintosh. The manual even mentions DOS and IBM. You have two choices, selectable by a switch on the side of the printer. The first choice gives you a subset of Diablo 630 control sequences, which gives you only the Courier 12-point font without boldface or italics, and so this mode is a waste. It's like using an AT to do the work of a four-function calculator and nothing else.

The second way you can use the LaserWriter Plus is with programs that support PostScript. Last year, only *Microsoft Word* supported PostScript, but several other word processing packages are now following *Word's* lead. As a page-composition language, PostScript is quite different from the embedded control sequences that most word processors handle.

While *Word* works fine with the LaserWriter Plus, it does not yet support any of the new fonts. The LaserWriter driver included with *Word* can actually support any PostScript printer, and a PostScript implementation does not require any fonts beyond the standard Helvetica, Courier, and Times Roman.

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P321



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Toshiba America, Inc., Information Systems Division

CIRCLE 203 ON READER SERVICE CARD



If you want to access the new fonts by programming in PostScript yourself, or if you want to modify the *Microsoft Word*.PRD and .INI files to include these fonts, you may still encounter some obstacles. Although the LaserWriter Plus manual lists the new fonts, it does not give the names of the fonts as they must be used in a PostScript program. Since Apple prides itself on the tininess of its Macintosh manuals, this is not surprising. It took a call to Adobe Corp. (the creators of PostScript) to get this information.

Here's another problem: For connection to a PC, the LaserWriter Plus has only a serial port. If you want to use the printer with programs that print only to parallel ports, you'll have to use DOS's MODE program to redirect LPT1 output to COM1. However, in both Diablo and PostScript modes, the LaserWriter normally uses XON/XOFF handshaking. So when the LaserWriter buffer is full, it will send an XOFF code back to the PC through the serial port. If your applications program thinks it is sending data through the parallel port (as it will if you've used MODE), nothing on the PC side will see that XOFF code. The result is that the LaserWriter Plus buffer will overflow, and the printer will skip pages.

Programs that support serial printers using XON/XOFF should work fine. Running at 1,200 bits per second (rather than 9,600) should help the MODE problem also. Actually, the LaserWriter Plus can do hardware handshaking, if you run a small PostScript program to enable it. Apple couldn't supply this information, but once again, Adobe came through.

In the year since *PC Magazine's* first review of the LaserWriter, Adobe Corp. has published two books on PostScript with a lot of programming examples. You can create PostScript programs with an ASCII text editor and just copy them down to the printer. Or you can get into a communications program and put PostScript into an interactive "executive" mode in which you manually type in PostScript commands. This is particularly useful for learning PostScript because the printer will send back error messages.

PostScript is on the way to becoming a standard for page description languages, but the LaserWriter Plus needs much more

The ImageStation, like Darth Vader, has hidden powers and great force.

software support before it can serve as a general-purpose PC printer. It's just too expensive to use mostly in Diablo-emulation mode. —Charles Petzold

Imagen Innovator ImageStation

If the Imagen Innovator ImageStation came in black, I'd call it the Darth Vader of laser printers—like Darth, it has hidden powers and great force. The Imagen ImageStation can pretend to be a lowly IBM 5152 Graphics Printer, but it's really a high-end laser printing system with page-composition intelligence and the ability to emulate several other printers.

The Imagen ImageStation is basically a Canon-engine laser printer controlled by an "intelligent" component called an Image Processor. The Image Processor controls the ImageStation's emulations and runs Impress, Imagen's built-in page-composition and graphics language. The ImageStation printer should sit atop the Image Processor for the smallest footprint and to allow easy access to the controls and indicators on both units.

The ImageStation is available in three configurations: the Executive with 256K bytes of RAM for text and chart printing; the 512K-byte Designer, which adds enhanced graphics printing; and The Innovator (the configuration we tested), which, with its 1.5 megabytes of memory, can handle very large documents as well as complex graphics. The ImageStation includes a facility for manually feeding business cards, envelopes, and odd and heavy paper stock.

Setting up and configuring the Imagen ImageStation is not for the faint of heart—

plan on at least half a day. You change or set the defaults using flat panel switches on the front of the Image Processor. You can change the settings for the current session only or save them to be the new system power-on defaults. The manual is fairly complete, although some details about the toner cartridge are missing.

A key feature of the ImageStation is "prerasterization," Imagen's proprietary system for processing pages completely in memory before printing. ImageStations with sufficient memory can hold many pages in memory and offer such luxuries as multiple copies, collation, and page reversal. Prerasterization is of even greater importance when used in page composition and graphics.

In addition to the page layout control Impress gives you, the ImageStation offers four emulation modes. Imagen's concept is that the ImageStation can replace all printers in an office. It can imitate the Diablo 630, AT&T 455, Epson FX series, IBM 5152 Graphics Printer, AT&T 473,



Imagen Innovator ImageStation Imagen Corp.

2650 San Tomas Expressway,
Santa Clara, CA 95052-8101
(408) 986-9400

List Price: \$7,200

Dimensions (HWD): Image processor,
3.75×18.75×18 in.; printer, 10×19×16 in.

Weight: Image Processor, 22 lbs.; printer,
50 lbs.

Made in U.S.A. and Japan (printer)

In Short: An expensive but powerful Canon-
laser-engine printer controlled by an intelligent
image-processing module.

CIRCLE 625 ON READER SERVICE CARD



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CIRCLE 278 ON READER SERVICE CARD

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Tektronix 4014 graphics terminal, and a standard ASCII 96-character line printer.

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5152 Graphics Printer codes but also produces print that looks like it came from an IBM 5152 printer—or rather, since the ImageStation is a laser printer, like a photocopy of the 5152's printout. When you

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CIRCLE 293 ON READER SERVICE CARD

For page lay-

out and heavy graphics work, you may need the ImageStation's power.

work in the emulation modes you also select "Simple Printer" mode to avoid translation into Impress and to use the ImageStation memory as a huge printer buffer and spooler.

If you don't use Impress, using the ImageStation to act as Diablo, Epson, IBM, and straight ASCII line printers is certainly possible, but I wonder how many people could afford such an expensive printer to replace just one or two conventional printers. In its least-expensive configuration, the 256K Executive at \$5,950, the ImageStation replaces a good assortment of printers that could be available for local use. If the ImageStation is the only printer in an office, what happens if (shudder) it should be out of service for a while. I'd hate to have to buy two just to have a backup.

The ImageStation is not a good choice if you need only a laser printer; it costs more than you need to spend and has features you may never use. But for page layout and heavy graphics work, you may need the ImageStation's power.

If you're in the ImageStation's intended market, you should base your purchase decision on an evaluation of both Imagen's page-design software, Impress, and the technical capabilities and characteristics of the ImageStation. Although the capabilities of the ImageStation as a desktop publishing system are beyond the scope of this series of printer reviews, you should investigate them to ascertain the printer's full value.

If you can use the ImageStation's emulation modes and want a laser printer with a huge buffer and spooler and some fancy document-handling characteristics, you have good reason to take a look at the ImageStation.—Bruce Brown

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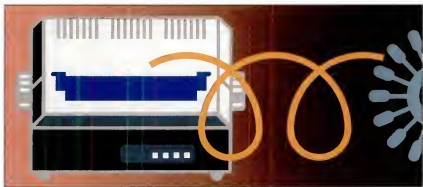
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CIRCLE 165 ON READER SERVICE CARD



DAISY WHEEL PRINTERS

JOHN DICKINSON

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SURE ARE BREATHING THEIR
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DAISY WHEELS—\$499

PC EDITOR'S CHOICE

This year's group of daisy wheel printers has three clear winners.

The Primage 100 is the first fully formed character printer with Epson-compatible graphics. And that's almost incidental to its role as a fast (57 characters per second), quiet (77 decibels), heavy-duty letter-quality printer. The Primage 100 gives you a complete printing system for \$1,895. Also worth mentioning is the optional triple-bin sheet-feeder.

The Quime LetterPro Plus offers 41-cps letter quality printing at just \$899, making it one of the fastest daisy wheel printers for anything close to the price. At 75 decibels, it's quiet enough to qualify as a pleasant office companion, and its 12-inch carriage width is the right size for letters, reports, and manuscripts.

For those who need a full-size carriage, the \$1,495 Fujitsu SP320E offers the same impressive 41-cps speed as the Quime LetterPro Plus with an even quieter (70 decibels) noise level.

cause although daisy wheel printers may clatter and clank, and although they may be slow, they're wonderful beasts, and I shall miss them when they're finally gone. The daisy wheel's twin nemeses are correspondence-quality dot matrix printers and laser printers. To a scrutinizing eye, neither alternative technology produces the same exact, crisp print of a daisy wheel. A laser printer doesn't even pound the dents in the paper that make your printouts look like the work of an expensive executive secretary's perfect execution of the Selectric Shuffle.

But PC users have spoken. They want quieter, faster printing, they want graphics and color, and they want more fonts and sizes than most daisy wheel machines offer. And they're willing to put up with lower-quality printing to get those things.

For those of you who still care to get the

finest in noisy computer printing, there are a few models left. Read on to see what this year's daisy wheel models have to offer—before it's too late.—John Dickinson

Cosmo World Adeus CP2000

The Cosmo World Corp.'s Adeus CP2000 is exactly what you'd expect in an inexpensive daisy wheel printer. It offers high-quality output, relatively low speed, and compatibility with the Diablo 630. Its most distinguishing features are that it's about \$100 cheaper and 2 to 3 characters per second faster than the equivalent printer in last year's crop—not a dramatic breakthrough but nevertheless a real step in the evolution of daisy wheel machines.

Print speed has always been the most significant shortcoming of fully formed character printers; even the fastest members of the breed barely top 60 cps on the PC Magazine Labs speed test. Just 1 year ago I tested a \$599 printer and thought it was doing well at 18 cps. In that context, the 20.2-cps rating for the \$499 Adeus CP 2000 is respectable indeed.

Given that fully formed character printers define letter quality output, the high readability level of the Adeus CP2000's output is no surprise. Still, "letter quality" can vary from matching the output of the average typewriter to indistinguishability from superior, IBM Selectric-produced type. The Adeus CP2000 is near the high end of this scale, and few printers can outdo it at any price.

Another important plus is the Diablo compatibility. Very few programs lack a driver for the Diablo 630. But if you need to delve into the printer's control codes, you'll find them easily enough in the Adeus CP2000's surprisingly thin but generally well-written and informative manual. The Diablo compatibility extends to using Diablo HyType II ribbons and 96-spoke Diablo or Quime plastic print wheels, common enough so that you won't have trouble finding them.

As with most fully formed character printers, the Adeus CP2000 is not particularly quiet, but the 72 decibels measured on the PC Labs sound tests is not bad for a daisy wheel. What's more, the sound qual-

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Actual unretouched photo of the monochrome display produced by Lotus 1-2-3 on a leading color graphics card.



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DAISY WHEELS—\$499

ity has more in common with a typewriter than with many daisy wheel printers. Call it slightly better than average.

Stacked up against all the good points are some important negatives. My first impression of the printer was that it was flimsy. The paper guide fell off when I went to put the platen tray in the machine, and it would not grip firmly afterwards.

I also found some curious problems when testing the printer. In particular, the boldface and double-strike features do not work together if boldface is set before double-strike. Although Cosmo World claims compatibility with Diablo 630 graphics, the printer would not work on the PC Labs graphics test. This is not much of a problem, since you are presumably buying this printer for its letter quality text output.

Despite these hedges, the Adeus CP2000 fares well in the low-end daisy wheel printer market. Output from the Adeus CP2000 is among the best from letter quality printers. If you don't need it for a heavy-duty application, and if speed is not an issue, why bother with a more expensive printer?—*M. David Stone*



FACT FILE



Cosmo World Adeus CP2000

Cosmo World Corp.
2975 Wilshire Blvd., #530
Los Angeles, CA 90010
(800) 553-5773
(213) 386-3683
List Price: \$499

Dimensions (HWD): 5.5×18.7×13 in.
Weight: 15.4 lbs.
Made in Japan

In Short: A low-end daisy wheel printer that's near the head of its class, offering high-quality text output and slightly better than 20-cps printing, all for \$499.

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The Option Board uses a half-size slot in an IBM PC, XT or AT (with at least 1 360KB floppy disk drive), Heath/Zenith 150, 151, 156, Compaq Deskpro, Extra \$15 cable required for Compaq Portable, HP Vectra and Tandy 1000. Tandy 1000 requires 256K of memory.

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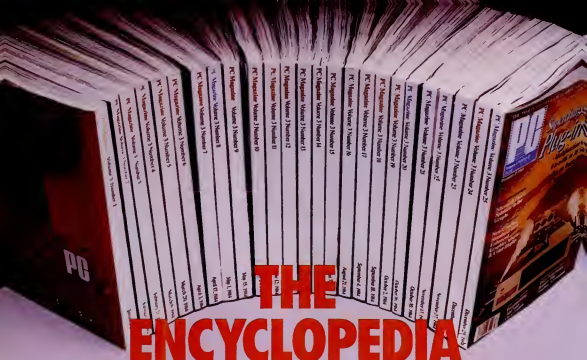
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DAISY WHEELS—\$549

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Although the Olympia ESW 1000C has two strikes against it in the daisy wheel printer game (it prints at only 14 characters per second and retails for \$549), it has some fine features to offset these negative



Olympia ESW 1000C and ESW 2000C

Olympia USA Inc.
P.O. Box 22
Somerville, NJ 08876
(800) 526-0912
(201) 722-7000
List Prices: ESW 1000C, \$549; ESW 2000C, \$799

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2000C, 33 lbs.

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In Short: Attractive daisy wheel printers (narrow- and wide-carriage versions) that offer excellent print quality and Diablo 630 compatibility.

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CIRCLE 219 ON READER SERVICE CARD



points. And although the wide-carriage ESW 2000C doesn't set any speed records, its tested 22 cps (2 cps above its factory rating) is significantly faster than the earlier generations of 8-, 12-, and 15-cps

low-end fully formed character printers.

The ESW 1000C and ESW 2000C are also fairly quiet, thanks to their case construction.

Another redeeming feature is print

quality. The ESW 1000C and ESW 2000C have superb print, rivaling that of the best daisy wheel printers and modern electronic typewriters. The print quality of most daisy wheel printers is above average, but these printers produce type that's just super: each letter has perfect registration, each is properly spaced, and each is uniformly filled from top to bottom.

The ESW 1000C and the ESW 2000C look like premium machines: angled, well constructed, modern. Accoutrements include a paper support and special paper guides on the paper bail. (One annoyance for right-handed users, though, is the single platen knob on the left-hand side of the unit.) The front-panel keyboard on both printers has a keypad for selecting print options. Three slide switches let you choose

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daisy wheel printers and
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proportional spacing, line spacing, and the appropriate pressure for the thickness of the paper used in the printers. To the left of the printers' slide switches, a compartment holds a DIP switch for selecting nine print parameters.

To ready the printers for operation, you need only snap in a cartridge ribbon and insert the daisy wheels in front of the printheads. The daisy wheels come in cassettes, so you never have to worry about ink fingers.

Noise is not much of a problem: plastic covers over the area where the printheads of both printers travel keep noise down to a moderate tap, tap, tap.

A printer like the ESW 1000C that prints at 14 cps—even a daisy wheel—is not right for everyone. But if you can live with this limitation, the ESW 1000C's re-

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DAISY WHEELS—\$549-\$645

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—Joe Desposito and Bruce Brown

Fortis DX25

It's a family affair: The **Fortis DX25**, a **Diablo 630-compatible** daisy wheel printer that uses standard daisy wheels and ribbon cartridges, is one of a family of **Brother/Dynas/Fortis** low-cost letter quality printers that have been on the market for several years. The brands differ only in name; the mechanical workings are the same, model for model. The 25 series, here represented by the **Fortis DX25**, is a good first printer for an office that is just starting to use personal computers and wants to get minimal correspondence capability for minimal money, for students who use their printers to churn out term papers and reports, or for someone who already has a dot matrix



FACT FILE



Fortis DX25
Dynas Inc./Fortis Computer Systems

6070 Rickenbacker
Commerce, CA 90040

(213) 727-1227

List Price: \$645

Dimensions (HWD): 6.1 x 22.7 x 13.1 in.
Weight: 25.5 lbs.

Made in Japan

In Short: An excellent **Diablo-compatible**, moderate-speed letter quality printer.

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CIRCLE 235 ON READER SERVICE CARD
PC MAGAZINE ■ NOVEMBER 11, 1986

DAISY WHEELS—\$645

printer and wants a letter quality printer.

The DX25 comes standard with a Courier wheel, and, depending on how you set its DIP switches, it's capable of printing 10, 12, or 15 characters per inch. Proportional spacing is also available.

Like most daisy wheels, the DX25 will underline, shadow print (vertical enhancement), and print in bold type (horizontal enhancement). It also prints red characters, using a small separate red ink ribbon.

You couldn't call the DX25 a speedster, but it achieved 25 characters per second on the PC Magazine Labs speed test, a respectable speed in true-letter-quality mode for an under-\$1,000 printer. Happily, the DX25 is also reasonably quiet for a daisy wheel printer, measuring only 71 decibels on our sound test. As befits output

The Fortis

DX25 would be a fine addition to the hardware stable in a small office, home, or dorm room.

from a daisy wheel, the print quality is beautiful.

Setting up the DX25 is simple, helped by the manual with its clear illustrations of every step in the process. One of the first features you discover with the DX25 is a nicely working auto-form-feed for loading single-sheet paper. However, without the optional tractor-feed mechanism, continuous form, or fanfold, paper will not stay straight. The options do include various sheet-feeders. The Brother/Dynas/Fortis group used to have an optional keyboard as well, which let the printer act as an electronic typewriter. The manual now includes simple instructions for setting up your computer to act as a direct input device for the printer.

Another useful feature is the copy function. After you push the front panel switch-

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DAISY WHEELS—\$645—\$695

es that tell the DX25 you want it to behave in copy mode, you simply send text as usual. The printer's buffer saves the text for later copying. The standard buffer is 7K bytes with options of 15K and 23K; a good rule of thumb is that saving a page of double-spaced type requires 2K of buffer.

The \$645 Fortis DX25 would be a fine addition to the hardware stable in a small office, home, or dorm room. In its intended use as a correspondence printer and light-duty office machine, it lives up to its family reputation and performs well.

—Bruce Brown

Facit D2000

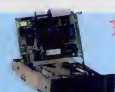
If you're in love with the artsy high-tech look, the Facit D2000's two-tone brown case probably won't earn it a place in your gallery; nonetheless, its quiet operation and crisp character formation might earn it a place in your office. Facit, a company that's been making typewriters since 1890, has managed a bit of magic in holding the normal daisy wheel racket to a muted 68 decibels. The D2000 outruns many other low-cost daisy wheel printers, but its 25-

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CIRCLE 236 ON READER SERVICE CARD

PC FACT FILE



Facit D2000

Facit Inc.

9 Executive Park Dr.
Merrimack, NH 03054
(603) 424-8000

List Price: \$695

Dimensions (HWD): 6.5 x 18.5 x 12 in.

Weight: 22 lbs.

Made in Sweden

In Short: A Diablo 630-compatible daisy wheel printer with somewhat quieter and faster operation than most low-cost daisy wheel printers but without a good holdface font.

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CIRCLE 172 ON READER SERVICE CARD

DAISY WHEELS—\$695

character-per-second rating in bidirectional mode may relegate it to a secondary role in your office, supplementing a fast dot matrix printer.

Since the D2000 comes without a pin-feed mechanism, plan on adding either the bidirectional tractor-feed option (\$195) or the soon-to-be-released single-bin cut-sheet-feeder (\$335) if you intend to use it for lengthy jobs. The printer does come equipped, however, with a work-saving paper injection system so that you won't have to lift the flip-top lid to load paper.

The flip top offers unrestricted access to a clean interior devoid of DIP switches; all the printer's controls operate through a panel conveniently located on the top of the cover (including the standard power-on, form- and line-feed, and pitch-selection functions) or through software. Only

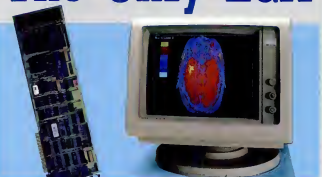
The D2000's

default print quality is excellent, thanks in part to the factory-supplied carbon ribbon.

two exceptions mar the D2000's well-ordered design. First, the parallel interface is located in the rear of the printer directly beneath the paper path. If you move your printer frequently, the requisite connecting and disconnecting would be more convenient with the interface located to one side of the paper path. Second, because you cannot swivel the daisy wheel upward before removing it, the space for mounting it to the printer's spindle is limited. Facit attempted to solve the problem with an unusual three-point tongue-and-groove design for fastening the daisy wheel to the spindle, which will prevent you from using industry-standard daisy wheels (Facit currently offers about 20 daisy wheels for the D2000 at about \$19 each). Ribbon cartridges are also proprietary in design.

The D2000 emulates a Diablo 630, but

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DAISY WHEELS—\$695—\$699

in the PC Magazine Labs tests it missed printing the pipe (vertical bar) character. The printer's default print quality is excellent, though, thanks in part to the factory-supplied carbon ribbon. You can select

from 10, 12, 15, or proportionally spaced pitches (you'll need a proportionally spaced daisy wheel if you choose the latter). The printer also features consistent registration, but in the case of the D2000,

that's both a virtue and a vice. The printer boldfaces characters by double-striking them, not by printing at a partial offset as most other printers do. With such accurate registration, the effect of the D2000's boldface is difficult to distinguish from its unenhanced print, and a photocopy of the original eradicates the difference entirely. The D2000's shadow print is dark and well formed, but unless you are using that feature from a program that allows you to control print attributes yourself, you may not be able to substitute shadow print for the less satisfying boldface.

Available in either parallel or serial interface versions, the Facit D2000 produces crisp output, and it is somewhat quieter and faster than most inexpensive letter quality printers. If you don't mind the lack of a good boldface font, this letter quality printer is worth considering, but since it prints at 25 cps, make sure you also have a speedy dot matrix printer on hand.

—Richard W. Ridington, Jr.

IBM Wheelprinter E

Something in the design of IBM printers carries the impression of solid dependability. The IBM Wheelprinter E is no exception. Priced at \$699, it's IBM's entry in the low-end daisy wheel printer market. It sports the same kind of sturdy good looks and clean, modern design as IBM's Proprinter. And yes, it prints well too.

Setting up the Wheelprinter E is simple, thanks in large part to the manual. The illustrations are so good that you could probably get the printer running just by looking at them.

Coming as it does from the company that created the Selectric typewriter, it's no surprise that the Wheelprinter E produces true Selectric-quality output. In fact, if print quality is your prime consideration, you'd be hard-pressed to find any printer that does better.

Unfortunately, I can't give the same high praise to the Wheelprinter's speed. The PC Magazine Labs speed test clocked the printer at just 17.5 characters per second (although it's factory rated at 16 cps, making it one of the few printers that tests faster than the manufacturer claims). While this speed is acceptable in a low-end daisy wheel printer, it's slower than that of

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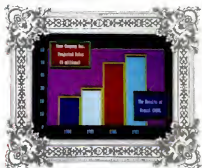
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The heart of Visual COBOL is an interactive mask editor that encourages an artistic approach to screen design. By extending ANSI standards and providing full text editing capabilities, Visual COBOL allows you to create your own masterpiece using a full palette of foreground and background colors. You can easily move, insert, or delete fields; create an unlimited number of windows; even add eye-catching screen animation. In addition, Visual COBOL provides program-controlled video attributes for changing I/O field definitions in real time.



Once you add the final touches to your screen design, the mask editor automatically preserves your work of art in a separate screen library. At the same time, a WORKING-STORAGE definition is created for your mask. It's that simple.

Visual COBOL gives you the screen management capabilities you need. It can make the difference between ordinary software, and software that sells. Just as important, Visual COBOL increases your productivity by saving you valuable time in both the design and coding stages of program development. What's more, screen modifications can be done without recompiling the program, so maintenance is easy.

In addition to providing impressive artistic capabilities, Visual COBOL also gives you high-speed native 8086 machine code, a lightning quick SORT, extended CHAINING features, a new interactive debugger, execution of DOS commands, multi-keyed ISAM structure, ANSI compatibility, GSA certification, and much more. Versions that support XENIX, UNIX, and both the IBM and Novell networks are also available.

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pcm

DAISY WHEELS—\$699

some printers that cost \$100 to \$200 less, and without any appreciable improvement in print quality.

Since the Wheelprinter E uses the same print wheels and ribbons as the IBM Wheelwriter typewriters, you have a choice of more than 40 print wheels and supplies are easy to get. I had trouble hunting up a replacement when the ribbon on the test machine broke, but in hindsight, that was probably because I was looking in computer, rather than office supply, stores.

I was surprised to find that the Wheelprinter E measured 79 decibels on PC Labs noise-level test; it just didn't seem that loud. The illusion of quiet has a lot to do with the quality of the noise, which is more of a loud rattle than it is the jackhammer sound I usually associate with daisy wheels. At any rate, IBM doesn't bother putting a noise cover over the printer mechanism, and I don't see a need for one.

In running the PC Labs printer benchmark tests, I came across one potentially troublesome problem. IBM claims that the Wheelprinter E is compatible with the IBM 5152 Graphics Printer, but the printer fouled up the vertical spacing and failed to underline on the PC Labs compatibility



IBM Wheelprinter E.
IBM Corp.

Contact your local authorized IBM dealer.

List Price: \$699

Dimensions (HWD): 8.5x21.3x14.4 in.

Weight: 29 lbs.

Made in U.S.A.

In Short: A low-end daisy wheel printer that offers solid dependability, high-quality output, and marginally acceptable speed.

Circle 400 on Reader Service Card

One or Two Things to Know About Your Laser Printer.

1. Production speed can be significantly improved.

As delivered, your laser printer rarely attains its production capacity of eight pages per minute. Somebody is forever stopping it to change papers — or to reload its paper bin. Under the best of circumstances, its capacity, 100 sheets, is only enough for 12½ minutes' operation.

What your laser printer is actually producing is one or two sheets per average minute; about what you could expect of an impact printer.

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Both the LaserFeeder and the MultiFeeder are products of BDT, the world leader in sheet feeder engineering and manufacture.

MultiFeeder

LaserFeeder

Flipper

Both are attractively priced. The LaserFeeder sells for about one third less than any other sheet feeder you might consider. The MultiFeeder is absolutely unique in capabilities. It is the only means of adding six bin capacity to your laser printer on the market today.

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CIRCLE 164 ON READER SERVICE CARD

BDT



DAISY WHEELS—\$699—\$899

test. So if you find that your software doesn't specifically support the Wheelprinter E, you may have to go in and modify the printer driver.

Very much on the plus side is an option-

al sheet-feeder. IBM did not include one for this review, but I've tested the sheet-feeder before, and it is one of the best I've seen. It more than makes up for anything the printer lacks in the ratio of performance

to price.

The IBM name can be a big selling point, often making up the difference in many people's minds between any gaps in the performance-to-price ratio. If you have no interest in the sheet-feeder, the value you place on the Wheelprinter E does indeed partly depend on how much you think the IBM logo is worth. But if you're thinking in terms of printer plus sheet-feeder, this package is easily worth the price, even before you factor in those three magic initials. —M. David Stone

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Qume LetterPro Plus

With the Qume LetterPro Plus's printing speed and the large heat sink on the rear panel, you just might believe you're driving a Harley Hog rather than a daisy wheel printer. Unlike a motorcycle, though, the LetterPro Plus is relatively inexpensive (\$899), quiet (only 75 decibels during PC Magazine Labs testing), and easy enough for a child to use.

Installing the unit on an IBM should

PC EDITOR'S CHOICE
FACT FILE



Qume LetterPro Plus

JTT Qume Corp.
2350 Qume Dr.
San Jose, CA 95131
(800) 22-DAISY
(408) 942-4000

List Price: \$899; optional tractor feed, \$150
Dimensions (HWD): 7.5x20.5x14.2 in.
Weight: 28.6 lbs.

Made in Japan

In Short: A daisy wheel printer that produces letter quality print while cruising at a very respectable 41-character-per-second speed.

CIRCLE 671 ON READER SERVICE CARD

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CIRCLE 262 ON READER SERVICE CARD

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Floppy-based technology (average media life expectancy: "hundreds of hours")	Hard disk technology (average media life expectancy: 11,000+ power-on hours)
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Bernoulli system costs you \$2695, plus \$280 for their controller. And at \$3775 for their 40 Mbyte dual-drive system with controller, it's easy to understand why they don't want you to see this comparison!

Like what you see? Find out more: Call our toll-free hotline for your copy of the Sysgen product family brochure, or for the DuraPak dealer nearest you.



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CIRCLE 367 ON READER SERVICE CARD

DAISY WHEELS—\$899

take almost as much time as unpacking it—not much. You simply attach a print wheel, insert the ribbon cartridge, connect a cable to your computer's parallel interface, and start printing. While the LetterPro Plus's front panel lacks many selections when compared to today's dot matrix printers, its touch-sensitive membrane switch panel does provide such essentials as form- and line-feeds. Two lights, ready and attend, provide status information.

At 41 characters per second in default mode, the LetterPro Plus virtually screams down the highway of daisy wheel printermode. Even in shadow print, it puts out a respectable 21 cps. A few years ago many expensive daisy wheels were chugging along at that speed in the default mode.

The LetterPro Plus's default mode pro-

At 41 cps,

the LetterPro Plus
virtually screams down
the highway of daisy
wheel printermode.

duces crisp, attractive output. The print enhancements, though limited, run the course for a daisy wheel: three levels of boldface print, a shadow print, and an underscore feature. The boldface output is extremely good in all its levels. If you combine the shadow and bold enhancements, though, you'll find that certain characters, such as F and W, appear slightly muddy. Also, because the printer is a daisy wheel, it has no true subscripts and superscripts. Thus, you need to approximate them by issuing half-line and negative half-line feeds.

Feeding paper without a tractor-feed is hassle free but may require some adjusting. Also, if your documents are longer than two pages and you tend to use the printer often, you had best invest in the optional \$150 tractor-feed mechanism. With-



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CIRCLE 493 ON READER SERVICE CARD



DAISY WHEELS—\$899-\$999

out it, the paper scrolls across the roller, and your output ends up on the roller rather than on the paper.

The adequately illustrated manual includes instructions on preventive maintenance

in addition to the standard sections on serial and parallel interfacing, control code sequences, and printer operation. What it lacks is an index; however, this deficiency is not as serious for a daisy wheel

as it is for a dot matrix or laser printer because of the limited number of commands.

The LetterPro Plus delivers what it claims—fully formed print at a very respectable speed. So, Easy Rider, what more could you ask for in a daisy wheel?

—Vincent Puglia

C. Itoh StarWriter D10-40

"What's in a name?" As Shakespeare told us, "... a rose by any other name would smell as sweet." But what about printers? Would a Diabolo by any other name print as sweetly? In other words, how does the C. Itoh StarWriter D10-40, a Diabolo clone and competitor that's been on the market for about 9 months, perform?

The print produced by the StarWriter D10-40, a Diabolo-compatible daisy wheel, looks pretty sweet. But why shouldn't it? Designed to compete with the Diabolo (and the NEC) daisy wheel printers, which set the standard for their breeds, C. Itoh's StarWriter D10-40 is one of a new generation of C. Itoh daisy wheels and a replacement for the F10-40. The StarWriter D10-



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C. Itoh StarWriter D10-40

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Torrance, CA 90502

(800) 423-0300, sales and marketing

(800) 348-1984, technical support

(213) 327-5939

List Price: \$999

Dimensions (HWD): 6×22.6×16 in.

Weight: 31 lbs.

Made in Japan

In Short: A wide-carriage Diabolo-compatible daisy wheel that offers high-quality print at a respectable speed and noise level.

CIRCLE 053 ON READER SERVICE CARD

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PC World on compatibility — Model of how RAM resident programs should be "**well behaved**."

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Computer Buyer's Guide & Handbook — "the Popular Programs programs are **superior in every way** ... DeskSet Plus rates the highest of marks."

PC Magazine — D. Barnes & S. Venit — "Our **number one choice** among the packages we reviewed is Pop-Up DeskSet, for the strength of its integration with DOS and for its speed. We were impressed with the program's ability to let us transfer data from the **Pop-Up DeskSet Plus** modules into our spreadsheet and word processing packages with a single, simple command, and it's straight-forward and easy to use and install, to boot."



EDITOR'S
CHOICE

Pop-Up DeskSet Plus

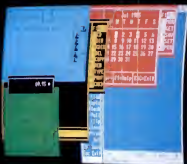
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Computer Retailer's Guide
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DAISY WHEELS—\$999

40 even uses a Diablo 96-character plastic daisy wheel (it can also use a Qume daisy wheel of this type) and requires a Diablo- (or Qume-) compatible cartridge-type ribbon. The StarWriter D10-40's Diablo and Qume similarities assure you that you'll be getting high-quality print when you dole out the \$999 you'll have to apportion from your hardware budget for the printer. But, again, for that price, why shouldn't you expect good-looking print?

If you feed it your fine letterhead—by hand, semi-automatically with the flick of a switch, or automatically with the optional BDT Model 521 or 522 auto-sheet-feeder—no one will guess that your secretary didn't type your correspondence using the smoothest-running Selectric typewriter (except perhaps that there will be no tell-tale Wite-out blotches). Letters typed in

Although

the StarWriter D10-40 prints at a respectable clip you couldn't call it a speed demon.

boldface overprint mode look especially impressive, though you sacrifice speed for looks in that case. If, for tradition's sake, you're pretending that you're still using a Selectric while the rest of the world is using a word processor and printer, the jig will be up when you use the printer's shadow mode, which is crisp and clear—great for headings and subheadings in reports. Proportional print mode works with shadow, boldface overprint, and underscore modes. You can also use the StarWriter D10-40's justify mode, backward and forward print modes, bidirectional print mode, and graphics mode, as well as set top and bottom margins and vertical and horizontal tabs.

As with all daisy wheels, you sacrifice speed for that great-looking print. Although the StarWriter D10-40 prints at a



DAISY WHEELS—\$999

respectable clip for a daisy wheel—about 31 characters per second in default (pretty near the factory-tested rates of 32 to 40 cps) and about 14 cps in boldface overprint mode—you couldn't call it a speed de-

mon. I wouldn't want to use this printer for drafts I'm trying to print out at the eleventh hour, but I'd opt for it every time for final presentation copy that's meant to impress the reader.

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CIRCLE 479 ON READER SERVICE CARD

The StarWriter D10-40's 8K-byte RAM buffer permits you to get on with something else while you're waiting for your hard copy. And its wide carriage (16 inches) means that you won't have to switch printers when printing spreadsheets.

Respectable is the term for the StarWriter D10-40's noise level, too: 70 decibels in my tests and factory-rated at less than 60 decibels. If you're sitting right next to the printer, you might have to take your phone calls when it's not printing, but if you're standing a mere 2 to 3 feet away, you'll consider it merely a "distant" hum.

Another reason for placing the printer at least a short distance away from you is its fairly substantial (but not unusual for a printer of this type) footprint. Although it will harmonize visually with your PC (it's IBM gray), the StarWriter D10-40 may conflict with your elbowroom, even

The D10-40 is one of the sturdiest I've seen. It even has a black rubber bumper like a Japanese compact car.

though the optional TEC F10 uni/bidirectional tractor adds only to the printer's height—4 inches, to be exact. (It adds \$249 to your bill, however.) Although I did not try the StarWriter D10-40 with the TEC tractor, I recommend that you do, since fanfold paper tends to shift quite a bit without it, and single sheets are a nuisance to feed into the printer.

Slight tremors in your California San Andreas Fault—zone branch won't shift the StarWriter D10-40 on your desk much; the 33-pound printer is one of the sturdiest I've seen. It even has a black rubber bumper around it, like a Japanese compact car. Although the sound cover looks slightly ill fitting (it overlaps the top a bit), it's solid and secure.

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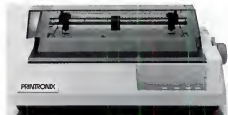
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CIRCLE 332 ON READER SERVICE CARD

DAISY WHEELS—\$999

In addition to its respectable sound level and speed, the Diablo-compatible StarWriter D10-40 also has a respectable look—dressed for success in its IBM colors. The C. Itoh nameplate is even IBM blue. The touch-sensitive control panel on the printer's right front is easy to read and use, with four controls: Stop/Continue (akin to on-line/off-line), LF for line-feed, Page-Adv (like top-of-form or form-feed), and Set-Page (to set the top-of-form). Three lights tell you whether the printer is on (Power) and on-line (Print On) and if the paper is empty, the cover is open, or the ribbon end is detected (Alert).

The manual suffers from some flaws common to the documentation of many printers made outside the United States (which means practically every printer reviewed in this issue). I stopped counting

The Diablo-

compatible D10-40 has a respectable look—dressed for success in its IBM colors.

the typos after the first few pages. In fact, the copy I received came replete with a correction sheet listing mistakes presumably uncovered after printing. Since the StarWriter D10-40 is available in serial and parallel versions, the manual covers setup and use of both. The coverage of the escape code commands is clear and easy to follow, but there's no index to help you when you want to find out how to do something fast.

But in an office setting where someone experienced or technically minded sets up the printer and maintains it and most users just turn it on and off, with no need to refer to the manual, the StarWriter D10-40 is about as user friendly as most in its category. Inserting and replacing the print wheel and the ribbon cartridge and loading paper are fairly foolproof. Setting the DIP

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DAISY WHEELS—\$999–\$1,495

switches involves the usual method of removing the cover and turning them on or off (or open and closed, as specified in the StarWriter D10-40's manual) by using a pen or small screwdriver, but at least the

switches are located in the front and at the top rather than somewhere in the StarWriter D10-40's dark distant innards.

With its high-quality print, wide carriage, pretty good speed and noise levels

for a daisy wheel, and all-around adaptability for an office setting with a large printing load, the C. Itoh StarWriter D10-40 is an attractive printer, especially for printing business correspondence and final, rather than draft, reports. If you can find it discounted about \$200 to \$300 from its \$999 list price, grab it, for the answer is, yes, a Diablo by any other name—in this case the StarWriter D10-40—does print as sweetly. —Carol Olsen Day

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Fujitsu SP320E

Who says printers that produce fully formed characters are dead? The Fujitsu SP320E is a relatively fast, fairly quiet, conventional daisy wheel printer that, with its full Diablo compatibility, may be just the right printer for medium-duty office printing needs.

Installation instructions for the SP320E's print wheel, ribbon, and DIP switches are clear, but they're not printed in the right order. You have to keep flipping the pages around in the otherwise excellent manual. That's unfortunate because there are a lot of DIP switches and



**EDITOR'S CHOICE
FACT FILE**



Fujitsu SP320E


Fujitsu America Inc.
Peripheral Products Div.
3055 Orchard Dr.
San Jose, CA 95134
(408) 946-8777

List Price: \$1,495
Dimensions (HWD): 6.3×21.7×15.0 in.
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In Short: A moderately fast and reasonably quiet daisy wheel printer with Diablo 630 compatibility and an excellent manual.

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DAISY WHEELS—\$1,495

The SP320E has a convenient method of auto-sheet-loading for single-sheet feeding.

controls: four DIP switch banks, three rotary selectors, and one sliding switch. All are located under the front dust cover. As a result, setting the DIP switches takes too long; I spent almost an hour checking to be sure everything was set correctly.

Once the switches are set, though, you can probably forget them for most uses, but the Fujitsu SP320E's antiquated method of parameter setting is very awkward when compared with other printers that have front-panel control with LCD read-outs of control settings.

Print quality on the SP320E is very good, depending on the font and the quality of the selected daisy wheel used in the printer. The printer case design also does a commendable job of keeping the sound level down to a pleasant 70 decibels.

The SP320E does not come with a tractor-feed mechanism, but two models are available as options, as are a selection of single-bin sheet-feeders. However, the Fujitsu does have a very convenient method of auto-sheet-loading for single-sheet feeding.

The SP320E's user manual is excellent. It includes comprehensive instructions for programming the printer's functions. While the English used has enough mistakes to indicate it's clearly a translation from another language, the occasional awkwardness does not spoil an otherwise fine manual that includes plenty of information for beginners as well as for those who like to make their own printer cables.

With the proper print wheel, the SP320E can print the PC higher-order character set. Since it has the ability to line-space in 48ths of an inch and column-space in 120ths of an inch, the SP320E can also handle rudimentary graphics. However,

I doubt many users will buy this printer to print graphics.

The printer is compatible with the Diablo 630 and follows the Diablo printer-control programming codes, assuring you that it will work with most major software. In sum, the quiet Fujitsu SP320E is a good value for organizations that need good-looking letter-quality print for medium-duty use and a fairly clear manual to show them how to get it from the printer with little fuss. Long live the Fujitsu SP320E fully formed character printer.—Bruce Brown

Olivetti DY450

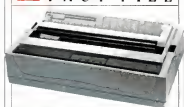
The Olivetti DY450 daisy wheel printer reminds me of the cars of the early 60s: it's big and fast and makes lots of noise. In fact, the variety of noises it emits lessens your confidence that it will stay in one piece.

Preparing the Olivetti DY450 for use takes a good while: figure on a minimum of 2 hours to get it set up and to familiarize yourself with the printer's workings. Fortunately, the well-written manual is very helpful.

First off, I found the Phillips screwdriver that Olivetti supplies for releasing ship-



FACT FILE



Olivetti DY450

Olivetti USA
765 U.S. Hwy. #202
Somerville, NJ 08876
(201) 526-8200
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In Short: A fast, noisy, somewhat complicated letter quality printer.

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CIRCLE 256 ON READER SERVICE CARD



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Although it measures only 72 decibels, the Olivetti DY450 seems louder.

ping screws insufficient and had to use one of my own. My biggest problem during installation, though, was with the ribbon. Olivetti gives you three options for ribbons: disposable cartridges, a ribbon zip-pack that fits into a refillable ribbon cartridge, and a ribbon spool and empty box that you thread yourself into the refillable cartridge. What you lose in convenience you gain in lower cost.

When my first attempt to thread my own ribbon cartridge took only 2 minutes, I began to feel pretty cocky. Then I tried to start printing and found that I'd put the ribbon in backwards. The second time took a bit longer than the first; I quickly became disenchanted. In light of the aggravation and the fact that I later had problems with ribbon alignment, which caused uneven print, I can't recommend "rolling your own," even if it saves a few dollars.

The Olivetti DY450 uses the widely available Olivetti print wheels. The mechanism for loading the print wheels is the most complex I've ever seen, involving pushing two levers to open the print wheel carrier and then snapping it all back together. Loading both ribbon and print wheel seemed to take much more effort and require a more intimate knowledge of the DY450's inner parts than with any other printer I've used.

The DY450 has a convenient control console (under a plastic cover on the printer's front panel) for selecting form length, characters per inch, paper-handling device or mode, and testing mode. The usual front panel buttons and lights are more confusing, however. The lights are set up in a fashion opposite that of most printers: rather than having an on-line/off-line light that glows when the printer is ready to print, the DY450 uses a "local" light. If

the local light is lit, the printer is ready to receive instructions from other printer buttons or controls (similar to most printers' off-line condition). When the local light is off, the printer is ready to take instructions from the host computer (as when the on-line light is glowing, for most printers). This switch from off-line/on-line to local/remote concept is fine, but why change from the standard?

The DY450 prints quickly for a letter quality printer, at 43 characters per second. Even though it measures only 72 decibels in sound level, it seems louder and comes with a whole assortment of noises, as if various parts are just waiting to work themselves loose and out of adjustment.

Most serious of all my problems was the DY450's tendency to print unevenly. I assume the ribbon somehow creased or slipped while printing. The blame may be mine for the way I threaded the ribbon into the cartridge, but this only underscores the false economy of letting users thread ribbons. All in all, I'd look elsewhere for a letter quality printer to handle heavy office printing.—Bruce Brown

Primage 100

What do you do if you need a high-speed, true letter-quality printer and occasional graphics? One solution is to buy two printers, but switching from one to another is an aggravation that also wastes precious workspace. The Primage 100 offers another choice.

The Primage 100 is a letter quality printer that follows Diablo command codes for document control. The Primage is also an Epson FX-80 series text- and graphics-compatible printer, using the print wheel's special dot spokes to create the required graphics. The Primage 100 also allows you to control bit-mapped graphics in two densities.

Using the Primage 100 in Epson emulation mode with applications programs is simple; you merely install the program for an Epson FX-80 if that choice is available, using FX or Epson mode if those are the only descriptors. All you need to do to the printer is set the appropriate DIP switch to Epson mode. The drawback to using the Primage 100 for graphics is its slow speed.

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Primage 100
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Ronkonkoma, NY 11779
(516) 585-8200
List Price: \$1,895
Dimensions (HWD): 7.4x24.5x15.5 in.
Weight: 53 lbs.
Made in Taiwan
In Short: A high-speed letter-quality printer
with Epson text and graphics emulation.
CIRCLE 61 ON READER SERVICE CARD

When printing graphics, the spokes have to strike repeatedly to form all images, in contrast with dot matrix printers, whose 9 or 24 pins hit at one time.

Rejecting the Primage 100 because of its slow graphics printing speed would be a mistake, though. If you print a lot of graphics, you should use a dot matrix printer or a plotter, but the Primage 100 is just the thing for printing an occasional chart or graph. The images it produces are clear and dark. Basically the Primage 100 is a high-speed daisy wheel printer: 57 characters per second in the PC Magazine Labs speed test (excellent for a letter-quality printer) and factory rated at 100 cps. Also, the printer doesn't make a lot of noise. At 77 decibels, it scores with typical dot matrix printers.

A big printer with sturdy components, the Primage 100 is intended for continuous commercial duty. It weighs 53 pounds, so you don't need to worry about it shaking itself off a table.

Several options for paper feeding are available, including a bidirectional continuous-form tractor-feed mechanism for \$2,195 (these prices include the printer); a single-bin sheet-feeder for \$2,295; a dual-bin feeder for \$2,495; and a triple-bin sheet- and envelope-feeder for \$2,695.

All paper loading and advancing is done via control buttons on the printer's top panel. There isn't even a platen knob for manual paper advance or rollback, a convenience I miss even though the buttons work easily and precisely.

Setting up the printer takes a while, requiring you to remove shipping screws and plastic retainers. Ribbon and print wheel installation is quick and easy. The DIP switches are on a top panel, three sets of eight switches each, with a quick-reference card inside the panel door. There are also switches for form width and paper thickness. Installing the tractor-feed mechanism takes longer than it should, largely because of unclear documentation.

Consider the Primage 100 for high-speed letter-quality printing. It's too expensive for home use but should be a real workhorse in heavy applications. The Epson emulation and graphics capability are handy additional features.

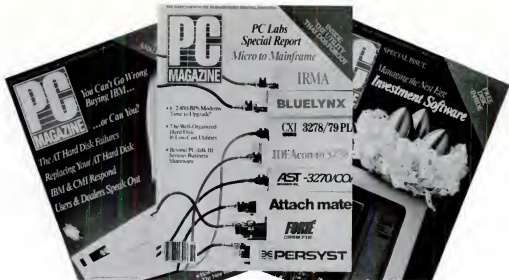
—Bruce Brown

Olivetti DY800

Despite Olivetti's stature as one of IBM's chief rivals in the European computer industry, it has never achieved a similar distinction in this country—not even cloaked beneath the skirts of Ma Bell, for whom it designed and continues to manufacture the AT&T 6300. But Olivetti hasn't given up on the U.S. market, as evidenced by the Olivetti DY800. A faster version of the DY450 (also reviewed in this issue), the DY800 zips along at a measured 55 cps, qualifying it as one of the fastest daisy wheel printers on the market.

The Primage

100 is just the thing for printing an occasional chart or graph. Images are clear and dark.



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DAISY WHEELS—\$1,899

The Olivetti

DY800 zips along at a measured 55 cps, qualifying it as one of the fastest daisy wheel printers on the market.

A striking graphic design on the top-mounted control panel, which includes on- and off-line, line-feed, and form-feed controls, gives this printer a European flair. Also European is the manual's obviously translated phrasing. Otherwise, the manual is helpful, well organized, and well illustrated.

To set up the printer, you have to install the daisy wheel. Before I could start, I kept fumbling in my efforts to open the printer cover, that required popping open the entire front half of the case. Inside, the printhead mechanism rides on a large mounted bar and includes the housing that holds the daisy wheel. To insert a new daisy wheel, you must first fit a small plastic adapter to it, then you just drop the daisy wheel into place and spin it once or twice to ensure that it's positioned properly. The adapter aligns the wheel for you, then you just snap the housing closed around it.

Unfortunately, this design means that you must use the pricey Olivetti daisy wheels, the same ET series daisy wheels found in the Olivetti daisy wheel typewriter: \$24.95 for standard and \$32.95 for "autorecognition" models. If you use the autorecognition daisy wheel, the DY800 scans an optical code embedded in the print wheel hub to detect the type of wheel you've installed, then determines its compatibility with the printer's internal character sets and with the settings established by your applications software. If, for example, you select 12-pitch printing while using a 10-pitch daisy wheel, the control panel will light to alert you.

Olivetti gives you a variety of paper-

handling options. A friction-feed mechanism is standard, but you can also obtain a bidirectional sprocket-feeder (\$184) for continuous forms. For feeding single sheets of paper, single-bin (\$449), dual-bin (\$619), and triple-bin (\$761) sheet-feeders are available. The triple-bin option includes two bins for paper and a third for envelopes from 4 to 14 inches wide.

At 78 decibels, the DY800 is one noisy printer, but, to be fair, that noise level is about average for a daisy wheel with the DY800's speed. You can, however, buy an optional single-sheet-feed acoustic cover to reduce this noise. This cover comes with left- and right-hand paper guides and an extra-high paper support that helps control those multipart legal-size forms that seem to fall everywhere but where you want them.

With the DY800's \$1,899 price, you're paying a premium for the additional speed this beauty offers. So, unless you must use multipart forms that need an impact-type printer, you might want to consider spending \$100 more for one of the new low-cost laser printers: not only are they quiet, but they make even fast daisy wheel printers seem positively slow.

—Richard W. Ridington, Jr.



FACT FILE



Olivetti DY800

Olivetti U.S.A.
765 U.S. Hwy. #202
Somerville, NJ 08876
(201) 526-8200
List Price: \$1,899
Dimensions (HWD): 5.6×21.7×19.9 in.
Weight: 31 lbs.
Made in Italy

In Short: A zippy but expensive daisy wheel printer that faces stiff competition from the new crop of low-cost laser printers.

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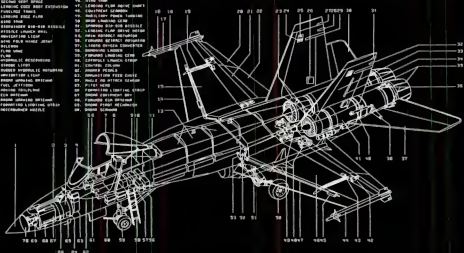
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THE RICOH LASER ENGINE

Challenging Canon's Laser Technology

The Canon LBP-CX laser engine, the guts of the Hewlett-Packard Laserjet printer, was once synonymous with laser engines. But in the past year, new—and better—engines have begun to challenge Canon's preeminence. Several companies have recently introduced their own engines, including Konica (used in the CIE LIPS 10) and Hitachi (the Qume LaserTEN, LaserTEN PLUS, and Genicom

5010), Mita (the Printronix 4012), Toshiba (DataProducts LZ2R1200), and Xerox (which manufactures a line of printers using its own engine). But the primary challenger to the Canon's market leadership is the Ricoh LP4080.

The technology used in both the Ricoh and the Canon engines (also discussed in "The Little Engine That Could," *PC Magazine*, Volume 4 Number 19) is similar in many respects, but the Ricoh engine boasts better print quality, a higher duty cycle, and a longer rated life expectancy. Ricoh rates its mechanism's work life at 600,000 pages, while the Canon engine allows only a 100,000-page lifetime.

Both the Ricoh and the Canon engines are sold primarily as OEM (origi-

nal equipment manufacturer) products. This means that a "raw" engine is shipped to a second company that designs and builds a controller circuit that will add value to the finished product. This value may be some special graphics or plotting applications language or even simply an RS-232 serial interface. Some of Ricoh's major OEMs for the LP4080 are Digital Equipment Corp., Burroughs, Quadram Corp., AST Research, Oasys, Texas Instruments, and (rumor has it) IBM Corp. for a forthcoming product. Canon's OEMs include QMS, Blaser, Cordata, Hewlett-Packard Co., Apple Computer, and Imagen. Both Canon and Ricoh also offer versions of their printers with their own controllers built in, thereby com-

The Ricoh LP4080 laser engine boasts important advantages over its closest competitor, the Canon LBP-CX, including better print quality, a higher duty cycle, and a longer rated life expectancy.

■ LASER ENGINES

■ The Ricoh scheme of applying the toner to the belt results in darker blacks.

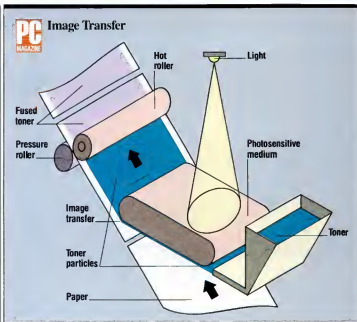
peting against their own OEMs. Ricoh's end-user printer is designated the LP4080R and is sold through its dealers. Canon markets four of its own printers, the LBP8A1, the LBP8A2, the LBP200SA1, and the LBP200SA2.

LASER PRINCIPLES All laser printers form characters on paper through the process of electrophotography, in much the same manner as office copying machines. This technique results in such advantages over conventional impact printers as speed, lack of noise, and high print quality. On the other hand, laser printers are generally more costly and difficult to maintain than impact printers.

Different laser engines use slightly different methods of electrophotography. In the Ricoh engine, a photosensitive belt is exposed to a light pattern that essentially mirrors the page image. It is at this step that you see the major difference between a laser printer and its ancestor, the copying machine. In a copying machine, the light source is the reflection of the bulb off of the document; in the laser printer, a low-powered laser directs its beam through a mirror directly onto the belt. The printer controller's electronics tell the engine when to turn the beam on and off as it scans across the page.

Next, black toner powder is applied to the belt, where the powder sticks only to the places that have not been exposed to the light. As the belt rolls, it comes into contact with the paper and transfers the toner there. Finally, the paper is fed through heated pressure rollers, which bond the toner to the paper.

The Canon LBP-CX engine operation differs from the Ricoh's in one major respect. Canon uses a drum in place of Ricoh's belt, and, unlike Ricoh's system,



To transfer an image to paper, all laser engines use a process called electrophotography. With the Ricoh engine, a light pattern that mirrors the page image shines onto a photosensitive belt. Black toner powder is then applied to the belt and sticks to the places that had not been exposed to the light. The paper is then rolled over the belt, where it picks up the image etched by the toner. The paper then proceeds through heated rollers that bond the toner to the paper.

the toner is attracted to the areas of the drum that have been exposed to laser light.

Although both printers are rated at 90,000 dots per square inch (300 by 300), the Ricoh scheme of applying the toner to the belt results in darker blacks, particularly in large dark areas, as well as sharper image and print quality. This improvement is most apparent when you print an inverse image.

Common to both the Ricoh and Canon engines is a controller circuit that acts as an interface between the printer and the host computer. This component takes protocol characters and printing directives from the computer and translates them into electrical commands that direct the laser and the mechanical components of the engine. The controller also furnishes other functions such as font selection.

Unlike the Canon engine, the Ricoh printer stacks its printed output pages face-

down, one on top of the other, so that you don't have to collate or reverse the page order. Unfortunately, the printer will not accept letter-size envelopes or anything other than 8½ by 11-inch, or A4 paper, severely limiting the engine's potential as an office's primary printer. Ricoh claims that this deficiency will be addressed in a forthcoming product.

MAINTENANCE Maintenance and set-up are roughly equivalent for the Ricoh and the Canon printers. The only drawback of the Ricoh is what can potentially be a messy operation: replacing the toner. While the Canon engine requires you to simply replace a cartridge filled with toner, the Ricoh uses an open bin which you must pour the toner into. This operation is no more difficult than the same procedure on a copying machine. You should be careful if you ship the printer with toner installed,

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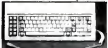
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■ LASER ENGINES

The top diagram shows that the major difference between laser engine technology and that of photocopiers is the source of the light that activates the photosensitive belt. In a copying machine, the light source is the reflection of a light bulb off the document. In a laser printer, a laser beam is reflected off of a mirror onto the belt.

The controller circuit (see bottom diagram) is the interface between your computer and your laser printer. This circuit takes the data from your PC and converts it into image data that can be output to the printer engine driver as control signals for the laser scanning beam.

because the toner has a tendency to spill if its container is not properly secured. While it's true that you need to change the toner

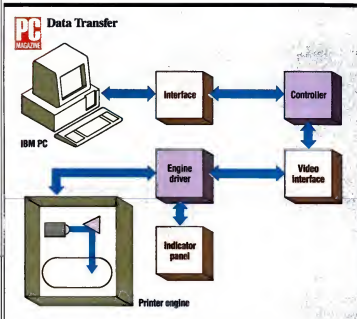
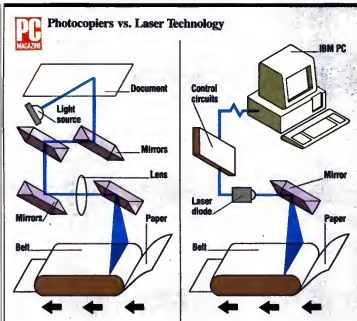
■ You need to add toner only after printing 6,000 pages on the Ricoh device.

and drum every 3,000 pages for the Canon engine, you need to add toner only after printing 6,000 pages on the Ricoh device. You must change the Ricoh engine's belt after 10,000 pages.

Ricoh has nominally priced the toner kit at \$84 and the belt replacement at \$199, or an average cost of about 3 cents per printed page over a nominal life span of 100,000 pages—not including any unscheduled maintenance. For these services, you will have to contact your OEM since Ricoh will only service its own end-user printer. Canon's printing cartridge containing toner and the imaging drum costs \$115.

The Ricoh LP4080 certainly is proving itself a formidable competitor to the Canon LBP-CX printer mechanism. The LP4080's high-quality printing, longer life span, and industry acceptance all contribute to ensuring its presence in the PC marketplace for a long time to come.

Bill Harris is president of Packaged Solutions, a communications software company in Melville, New York. He writes frequently for PC Magazine.



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■ PC LAB NOTES: PRINTER CONTROL ■ JOHN DICKINSON

MASTERING YOUR PRINTER'S OPTIONS

Printing handsome, finely tailored reports is often an elusive goal. But these simple tricks can put printer control right in the palm of your hand.

If you're like most PC users, much of your printer's power is going untapped. You depend on your word processing, spreadsheet, or database software to tell your printer how to format and print letters, spreadsheets, and reports. And in truth, these programs generally do a good job of giving you control over the use of boldface or underline type, compressed or wide print, or correspondence-quality type fonts.

But that's probably not enough to meet all of your printing needs, especially when it comes to printing the simpler things, such as the results of DOS commands. For example, if you want to print the output from the DIR command (which lists files in the specified directory), the TREE command (which lists subdirectories on the disk), or the CHKDSK command when used with the /V option (which lists files in each subdirectory on the disk), you'll probably have to be satisfied with your printer's default print options.

That's no help when you want compressed type to save space, or correspondence-quality output for a neat-looking report. To use those print options for DOS commands (or for output from programs that don't do a good job of setting up your printer), you can use one of the widely available commercial printer setup and control utilities (see sidebar "The Right Setup"). Or you can run Jeff Prosis's powerful SETUP.COM program (see PC Magazine, Programming/Utilities, Volume 5 Number 12), which is a resident utility that's always on call to control your printer's options.

COPY TO THE PRINTER As is so often the case, it turns out to be simple enough to get the job done using DOS's own tools. There are one or two obstacles to overcome, but that's half the fun of using your PC in the first place.

If you're at all handy with DOS, you probably already know that the printer can be treated just like any other output file. Whenever you direct output to a file called PRN or LPT1 using a DOS command, you're actually telling DOS to use the printer. The easiest way to demonstrate how this works is to type something on your printer using the COPY command. Something simple will do. Try typing the following (remember that the keyboard/

screen combination can also be treated as a file called CON):

COPY CON PRN

The brown fox jumped into print
Z

Once you enter Z (by pressing the Ctrl and Z keys simultaneously or by pressing the F6 key alone) your printer will produce a copy of what you have just typed on the screen. Be sure to type a carriage return at the end of the typed line before you press Z—many printers won't print the results if you forget to do this one small thing. You can print any file consisting of standard text characters using the COPY PRN command.

TYPE TO THE PRINTER An alternative way to ship files to the printer is to redirect the TYPE command so that the output goes to the PRN file (printer, that is) rather than to your console screen. To do that, enter

TYPE anyfile.DOC > PRN

The right arrow (some people call it a greater-than sign) is DOS's output redirection symbol: it tells DOS where you want screen output to go.

So, what does all this have to do with controlling your printer? It turns out that it's not difficult to create files containing printer control sequences (often called escape sequences), and then COPY the files to PRN, or TYPE them and redirect the output to PRN. Those files can contain control codes that will switch on whichever

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■ PC LAB NOTES

er options you want your printer to use when printing your DOS, or other program, output.

ESCAPE CODES There's only one stumbling block on the way to carrying this theory out: printer control codes always contain nonprinting characters; they also usually include what's called the *escape code*. The escape code, accessed by using the Esc key on your keyboard, is ASCII character number 27—that's CHR\$(27) for you BASIC fans. DOS treats it differently from other characters: whenever DOS sees the escape code, it prints a backslash (\) on-screen and cancels the current line. The Ctrl-Break (or Ctrl-C) combination cancels the current line too, but DOS has other uses for Ctrl-Break that make it more powerful than the escape code. Try it: type in any command at the DOS prompt, but instead of ending with Enter, hit the Esc key. You'll see that it seems to hang the system because Esc has cancelled the command. To get your prompt back, hit the Enter key. Clearly, you can't use any of DOS's typing or editing facilities (including EDLIN) to enter the escape codes needed for printer control.

A good alternative is to use any word processor that lets you enter escape codes (such as *Microsoft Word*, *WordStar*, or *XyWrite*) or a capable text editor (such as the *IBM Personal Editor* or the *Norton Editor*). But even if you don't have one, you're not out of ways to do this.

DOS comes equipped with two programs that can help you out: one is the BASIC interpreter and the other is DEBUG. Since more of you already know BASIC, let's start there. Suppose you want to set an Epson, IBM, or compatible printer to print in double-strike type for denser printing. The code for that is Esc G, struck in sequence rather than simultaneously. The code to disable double-strike printing is the sequence Esc H.

BASIC PRINTER CONTROL You can use BASIC to create one file containing the correct code to enable double-strike printing, then another to disable it. You'll need to look up the codes for your printer in its manual if it's not an Epson, IBM, or compatible. Start BASIC and type in the program given below. (If you've never used

BASIC before, here's what you need to know: Log on to a directory with *BASICA.COM* on it and type *BASICA* to begin. Now type in the program that follows. When you're finished, enter *SYS-TEM* on a line of its own to exit to DOS.)

```
10 OPEN "DS-ON.PRN" FOR OUTPUT AS #1
20 OPEN "DS-OFF.PRN" FOR OUTPUT AS #2
30 PRINT #1, CHR$(27) + "G";
40 PRINT #2, CHR$(27) + "H";
50 CLOSE
```

After running this program, you can use the two files you've created (*DS-ON.PRN* and *DS-OFF.PRN*) to enable and disable double-strike printing by using the *COPY* command or the *TYPE* command with redirection:

```
COPY DS-ON.PRN PRN
```

or

```
TYPE DS-ON.PRN > PRN
```

You can turn these lines into simple batch files to save typing whenever you run them. To create a batch file called *DS.BAT* that triggers double-strike mode, first log on to the disk or directory with the *DS-ON.PRN* file. At the DOS prompt type

```
COPY CON DS.BAT
COPY DS-ON.PRN PRN
Z
```

Now, whenever you want to turn on the double-strike mode, you need type only *DS* at the DOS prompt; make sure you're logged on to the correct directory, of course. You'll need to write other batch files to give you the same control over printer codes.

WRITING WITH DEBUG The other tool DOS furnishes is *DEBUG*, which lets you enter any type of character as long as you're willing to use hexadecimal ASCII sequence numbers for it. The hexadecimal equivalent for 27 (the decimal sequence number for the escape code) is 1B, and the hexadecimal sequence numbers for G and H are 47 and 48 (the decimal equivalents are 71 and 72). *SideKick's* ASCII table is a good place to look up hexadecimal values. Many printer manuals also list both numbers.

Start *DEBUG* and use the *E* (for enter) command to start entering data at offset 100 (the dash is the *DEBUG* prompt):

```
DEBUG
```

```
-E 100
```

DEBUG will respond by typing the current segment (which can be almost any four-digit hexadecimal number and will vary from one system to another, so don't worry about its value), followed by the offset you specified and the current value contained in memory (which can be almost anything), followed by a period:

```
4E58:0100 6F.
```

Enter the value you want (1B in this case), then press the Spacebar. *DEBUG* will respond by showing you the value of the next byte in memory, again followed by a period:

```
4E58:0100 6F.1B 72.
```

Once again, enter the value you want (47 in this case), but this time press the Enter key to tell *DEBUG* you've finished entering data:

```
4E58:0100 6F.1B 72.47
```

You have to issue two commands in order to write the file to disk. First you have to use the PC's *CX* register to tell *DEBUG* how many bytes you want to write. Use the *R* (for register) command to tell *DEBUG* you want to modify the contents of the *CX* register:

```
-R CX
```

DEBUG will respond by showing you *CX's* current value and giving you a colon prompt for entering a new value. In this case you'll enter a 2 for the 2-byte code you just entered, but you must remember to use hexadecimal values for numbers above 9:

```
CX 0000
:2
```

All that's left for you to do is name the file (*DS-ON.PRN*) and tell *DEBUG* to write it. The *N* (for name) and *W* (for write) commands will do just fine:

```
-N DS-ON.PRN
-W
```

Ever thoughtful, *DEBUG* will tell you it's writing your file using the following message:

```
Writing 0002 bytes
```

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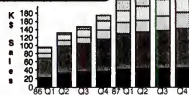
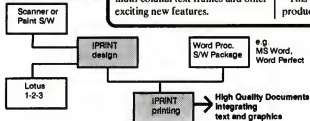
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PC MAGAZINE ■ NOVEMBER 11, 1986

■ PC LAB NOTES

To create DS-OFF.PRN, you can repeat the same steps without exiting DEBUG. Here's the whole session:

```
-E 100
4E58:0100 1B. 47.48
-R CX
CX 0002
-N DS-OFF.PRN
-W
Writing 0002 bytes
```

Notice that offset 100 already contains the correct value of the escape code (1B), so press the Spacebar to leave it alone. When you're done, leave DEBUG by using the Q (for quit) command:

```
-Q
```

Now you're all set to use COPY or TYPE with redirection, just as before.

The more adventurous among you will probably find the idea of writing a program to control your printer more satisfying than just using DOS commands with special files. You can easily use BASIC programs or check into the fast lane by writing small, .COM-format assembly-language programs using DEBUG's mini-assembler. Here's how.

Writing a BASIC program to the printer directly is easier than with the earlier program that writes the DS-ON.PRN and DS-OFF.PRN files. All the program has to do is use BASIC's LPRINT (write to printer) command to send the correct control characters to the printer. Here's the version for enabling double-strike printing:

```
10 LPRINT CHR$(27) + "G";
```

If you want to make the program operate more like a DOS command, you can add a BASIC SYSTEM command that conveniently invokes BASIC from DOS to operate the program and return you to the operating system. The final product (save it as DS-ON.BAS) will look like this:

```
10 LPRINT CHR$(27) + "G";
20 SYSTEM
```

To run the program from DOS, just type

```
BASICA DS-ON
```

Once again, you can write a batch file to save you from typing BASICA and the escape code filename repeatedly; just be sure you have BASICA.COM and the program

logged on to the same directory.

Using the DEBUG mini-assembler to write .COM programs to control your printer is more challenging, but it's not difficult, especially after you've done a few of them. The .COM program shown here comes in two parts.

The first part is a subroutine that sends a character previously loaded into the

■ DOS comes with two programs that can help you out: the BASIC interpreter and DEBUG.

microprocessor's AL register to your printer by using the PC's ROM BIOS printer interrupt, INT 17h. The second part loads each control character into the AL register and then calls the subroutine, which sends it to the printer. There is no limit to the number of times you can call the subroutine or which character you ask it to send to the printer.

Start DEBUG as before and issue an A (for assemble) command. DEBUG starts you off at offset 100, as indicated by the 0100 to the right of the colon. Start by typing in the following subroutine (this time, we're substituting xs for the segment location values, since they vary depending on your configuration):

```
-A
XXXX:0100 JMP 10A
XXXX:0102 MOV AH,0
XXXX:0104 MOV DX,0
XXXX:0107 INT 17
XXXX:0109 RET
XXXX:010A
```

The JMP instruction at the beginning sends control to the subroutine calls (which start at address 10A) when the program starts executing. After the RET command, let DEBUG know you've finished entering instructions by hitting a carriage return when the next offset location (010A) appears.

It's a good idea to save this subroutine as a separate file. As you'll see, you can

easily add to it later whenever you want a new printer control program. To save it, type the following:

```
-R CX
CX 0000
:A
-N PRT-SUB.COM
-W
Writing 00A bytes
```

The A you type in represents the number of bytes you want DEBUG to write to the file (A is the hexadecimal equivalent of decimal 10). This value is determined by noting the offset location of the last line DEBUG gave you (the number to the right of the colon) and subtracting hexadecimal 100 from it.

In other words, DEBUG is tracking how much memory your instructions are occupying and keeping you up to date every time you enter a line of instructions. Since you want DEBUG to save this much data in a file, you must tell it how many bytes to register to the CX register. DEBUG started your file at offset 0100, so the number of bytes you need to write to disk, in this case, is 10A minus 100, or A. (You'll find that a calculator like *Side-Kick's*, which does decimal-to-hexadecimal conversions, is an invaluable tool when using DEBUG.)

You can add the control codes for enabling double-strike print without further ado. Just tell DEBUG to begin assembling again, only this time tell it to start at address 10A:

```
-A 10A
XXXX:010A MOV AL, 1B
XXXX:010C CALL 102
XXXX:010F MOV AL, 47
XXXX:0111 CALL 102
XXXX:0114 INT 20
XXXX:0116
```

Stop DEBUG's mini-assembler by pressing the Enter key at the last line, as before. To write out your new program, use the same commands as you did before, but name this new program DS-ON.COM and enter the correct number of bytes (16) to write

```
-R CX
CX 000A
:16
-N DS-ON.COM
-W
Writing 016 bytes
```

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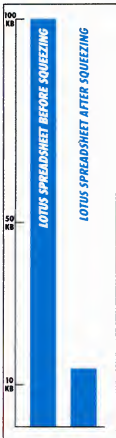
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■ PC LAB NOTES

THE RIGHT SETUP

Commercial printer setup utilities can do more than turn print modes on and off your printer. Here's a quick glance at what's on the market.

If you don't want to create your own printer setup utilities, here are a few prewritten commercial programs with the task already completed. Most of the commercial printer setup utilities listed below do more than simply initialize your printer. Each program has its own

special features and extra functions. If you have a graphics-capable printer, often the font options can be endless and are limited only by the software.

Although setup software for Epson's dot matrix standard is widely available, software for many other printers is not

easily found. However, many of the newer printer utilities recently introduced initialize laser printers, using the Hewlett-Packard Laserjet as a standard.

If you intend to buy a setup program, make sure it is exactly compatible with your printer.

Printworks for Laser Printers

SoftStyle, Inc.
7192 Kalamianale Hwy.
Honolulu, HI 96825
(808) 396-6368
List Price: \$125
Requires: DOS 2.0 or later, 256K RAM. For HP Laserjet, HP Laserjet Plus, HP Laserjet 500 Plus, NCR 6416, and Xerox 445 printers.
Not copy protected.

CIRCLE 548 ON READER SERVICE CARD

LQ

Granny's Old Fashioned Software
Rt. 4, Box 216
Boone, NC 28607
(704) 264-6906
List Price: \$35
Requires: 80K RAM, DOS 2.0 or later. For IBM Proprinter, Epson, Star, and C. Itoh printers.
Not copy protected.

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Facelift 2

Companion Software Inc.
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Beverly Hills, CA 90036
(213) 462-2759
List Price: \$49.95
Requires: 64K RAM, DOS 2.0 or

later. For Epson FX.
Not copy protected.
CIRCLE 620 ON READER SERVICE CARD

ConoFont Manager

Conographic Corp.
17841 Fitch
Irvine, CA 92714
(714) 474-1188
List Price: \$70
Requires: 256K RAM, DOS 2.0 or later. Works with HP Laserjet Plus, WordStar 2000 (Version 2 or later), Microsoft Word (Version 2 or later), WordPerfect (Version 4.1 or later).
Not copy protected.

CIRCLE 618 ON READER SERVICE CARD

Printworks for the IBM and Dot

Matrix Printers
SoftStyle, Inc.
7192 Kalamianale Hwy.
Honolulu, HI 96825
(808) 396-6368
List Price: \$69.95
Requires: DOS 1.1 or later, 128K RAM. For C. Itoh, Centronics, Epson, IBM Graphics Printer, Informant, NEC, Okidata, and Star printers.
Not copy protected.

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Printer Boss

Connecticut Software Systems Corp.
30 Wilson Ave.
Rowayton, CT 06853
(800) 321-0409 for orders
(203) 838-1844
List Price: \$129.95
Requires: 128K RAM, DOS 2.0 or later. For IBM Proprinter, Epson printers.
Not copy protected.

CIRCLE 614 ON READER SERVICE CARD

LaserSet

Euro-Software Services Inc.
13080 S. Belcher Rd., Suite B
Largo, FL 33453
(813) 536-8586
List Price: \$50
Requires: 128K RAM, DOS 2.0 or later. For HP Laserjet and Laserjet Plus.
Not copy protected.

CIRCLE 616 ON READER SERVICE CARD

Adapta-Print

Comp-Sy Inc.
1900 N. Winslow Rd.
Knoxville, TN 37919
(615) 693-0551
List Price: \$89
Requires: 30K RAM above applica-

tion, DOS 2.0 or later. For IBM PC-compatible graphics printers.
Not copy protected.

CIRCLE 618 ON READER SERVICE CARD

SetHP

Orbit Enterprises Inc.
799 Roosevelt Rd.
Building 6, #1
Glen Ellyn, IL 60137
(312) 469-3405
List Price: \$49.95
Requires: 96K RAM, DOS 2.0 or later. For HP Laserjet and Laserjet Plus.
Not copy protected.

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KeyType

Softkey Software Products Inc.
260 Richmond St. W., #300
Toronto, Ont., CND M5V 1W5
(416) 598-5033
List Price: \$59.95
Requires: 64K RAM, DOS 2.0 or later. For IBM Proprinter, Epson printers.
Not copy protected.

CIRCLE 617 ON READER SERVICE CARD

To enable double-strike you simply type

DS-ON

You can create the program to disable double-strike printing (DS-OFF.COM) in one of two ways: stay in DEBUG and reassemble the appropriate portion of the program (to change the value moved into the AL register); or leave and then restart DEBUG in order to modify the DS-ON.COM subroutine you created before.

If you choose the latter method, you can start DEBUG this way:

DEBUG DS-ON.COM

In either case, it's probably a good idea to list the program using DEBUG's U (for unassemble) command before you start changing it:

```
-U
XXXX:0100 EBFB      JMP     010A
XXXX:0102 D400      MOV     AX,00
XXXX:0104 D40000     MOV     DX,0000
XXXX:0107 CD17      INT     17
XXXX:0109 C3        RET
XXXX:010A DB1B      MOV     AL,1B
XXXX:010C DBF3FF     CALL    0182
XXXX:010F DB47      MOV     L,47
XXXX:0111 DBEEFF     CALL    0182
XXXX:0114 CD28      INT     28
```

Next, start assembling your new codes in the instructions where they need to be changed. In this case, all you have to do is reassemble the instruction at location 10F; type in the following:

```
-A 10F
32B3:010F MOV AL,48
32B3:0111
```

Have DEBUG write your new program to disk (if you didn't restart DEBUG, the CX register will probably contain the correct value):

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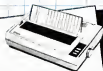
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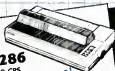
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■ PC LAB NOTES

```
-R CX
CX 0000
:16
-N DS-OFF.COM
-W
Writing 0116 bytes
```

You can change the codes in your program or add new ones any time you want. This will be easier if you start with PRT-SUB.COM when you make up new versions. Be sure that you include the INT 20 (exit program) instruction at the end of any new version of the program.

FRESH PAPER One version of this program that I simply can't live without inserts a fresh page into your printer. It's handy for keeping any type of printer's paper correctly aligned, and it's a real must

■ These programs can serve as the base for a full set of customized printer control tools.

for laser printers because they won't print anything until they have a full page of data or are forced to eject a page. That program (I call it PAGE.COM) looks like this when it's unassembled (to create the program, enter the instructions in the two right-hand columns):

XXXX:0100 EB00	JMP	010A
XXXX:0102 D400	MOV	AX,00
XXXX:0104 DA0000	MOV	DX,0000
XXXX:0107 CD17	INT	17
XXXX:0109 C3	RET	
XXXX:010A D00C	MOV	L,0C
XXXX:010C EB3F0F	CALL	0102
XXXX:010F CD28	INT	28

Now that you know several ways to send printer control codes to your printer, it's up to you to choose your favorite. The programs we've covered can serve as a base for a full set of customized printer control tools. After some experimentation, you'll be amazed that you ever got along without them.

John Dickinson is the editor of Computers in Banking and a contributing editor of PC Magazine.

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QUICK-CHANGE ARTISTRY



By using CHANGE.COM, you can change text strings and ASCII codes throughout a file faster than you can load your word processor.

Do you ever receive text files with embedded printer codes that are incompatible with your printer? Or do you have forms on which you need only the names? Or have you discovered that the correspondence you just finished should have been addressed "Mrs." instead of "Mr."?

Then CHANGE.COM is for you. To make major repairs to your text files you should load up your trusty word processor, but for quick-and-dirty search-and-replace operations on files up to 40,000 bytes in length, CHANGE offers a refreshing change. The format you employ to invoke CHANGE is

```
CHANGE filespec findstring replacestring
```

Filespec supports different drives or paths in addition to the filename and its optional extension. The strings can be made up either of text characters enclosed in quotes or of decimal ASCII codes separated by commas, or any combination of these two. The three elements, *filespec*, *findstring*, and *replacestring*, must be separated by one or more spaces. For example, to replace the printer code ESC-I in a file called MYFILE.PRN with asterisks, at the DOS prompt you could either give the command

```
CHANGE MYFILE 27,"-I" "*"
```

or

```
CHANGE MYFILE 27,"-I",49 "**"
```

If you need to find and replace the quotation marks themselves, simply embed them in a string. For example, to replace

the phrase "a quote " " with the phrase "an accent " " you would enter

```
CHANGE MYFILE "a quote " "an accent "
```

CHANGE is case-sensitive. That is, if asked to find and replace "paul" with "Bill," the program will not find "Paul" and no change will be made. On the other hand, it's easy to change more than you in-

tend. If you try to change the sentence "My cat is catatonic" to "My dog is catatonic" by entering the command

```
CHANGE MYFILE "cat" "dog"
```

you will get "My dog is dogatonic." To avoid this, instead of seeing a veterinarian, surround the "cat" by spaces. The proper command would look like

```

; Change.com
; A find and replace utility for text files.
; Format: CHANGE filespec findstring replacestring
; The strings have to be in quotes or decimal ASCII
; Multiple codes in a string are separated by commas
; e.g. CHANGE MYFILE 27,"-I" "*"

CODE SEGMENT
ASSUME CS:CODE,DS:CODE
ORG 100H

START:      JMP     BEGINNING

;
; DATA AREA
;
FILE_START  DW  ?
FIND_CNT    DW  0
REPLACE_CNT DW  0
CHANGE_FLAG DB  0

SYNTAX_MSG  DB  'Syntax error$'
NOT_FOUND$  DB  'File not found$'
TOO_BIG$    DB  'File too big$'
CHANGED$    DB  'Not Changed$'
COPYRIGHT   DB  'Copyright 1986 Sift-Davis Publishing Co.,1ah
            DB  'Programmed by Michael J. Mefford,1ah

; CODE AREA
;
; First we will parse the filename and the two strings.
;
BEGINNING:  MOV     SI,00H           ;Point to parameters.
            MOV     DI,OFFSET SYNTAX_MSG ;Point to syntax message.
            CLD                     ;Move in forward direction.

```

(continues)

Figure 1: The assembly language source code for CHANGE.COM.

■ PROGRAMMING/UTILITIES

```
CHANGE MYFILE " cat " dog "
```

To delete a string simpliciter, simply replace it with a null string. For example, to find and delete all carriage returns and line-feeds in MYFILE, enter

```
CHANGE MYFILE 1,3,10 ""
```

If one or more matches are found, CHANGE will report its success with the simple prompt "Changed." The program has three error messages: "Syntax error," "File not found," and "File too big." Of these, syntax will probably be your most common. Be sure to separate the two strings from each other with one or more spaces and to separate different strings within a string with commas. To keep the code of CHANGE to a minimum, I limited the size of valid files to those of less than 40,000 bytes. For larger files, dig out your regular word processor.

■ To keep CHANGE code to a minimum, I limited valid file size to 40,000 bytes. For larger files, use your word processor.

MAKING CHANGE The three ways you can get your own copy of CHANGE .COM—by modem, by assembling it from the listing shown in Figure 1, or by creating it through the BASIC program shown in Figure 2—are explained in the sidebar "Downloading CHANGE." While the assembler listing (Figure 1) is extensively documented, some overview of how the code works may be desirable.

UNDERSTANDING CHANGE.ASM More than half the code in CHANGE .ASM is dedicated to that tedious but necessary chore of parsing the command line, which begins at offset 80h in the Program Segment Prefix. The code involved in parsing the command line includes the sec-

```
CALL SPACE ;Parse leading spaces.
MOV FILE_START,SI ;We now point to filename.

FILE_BYTE: CMP BYTE PTR [SI],13 ;Is it a carriage return?
JZ EXIT ;if yes, exit with syntax error.
CMP BYTE PTR [SI],32 ;Is it a space?
JZ ASCII ;if yes, end of filename
INC SI ;else, point to next byte
JMP SHORT FILE_BYTE ;and check it.
ASCII: MOV BYTE PTR [SI],0 ;Make filename into ASCII.

CALL SPACE ;Parse the spaces.
MOV CX,CX ;Set string counter to zero.
MOV DI,OFFSET FINDS ;Point to find string storage.
FIND_BYTES: CALL STRING ;Get string.
CMP BYTE PTR [SI],32 ;Are we now pointing to space?
JZ REPLACE ;if yes, done here.
CMP BYTE PTR [SI],13 ;Is it a carriage return?
JZ EXIT ;if yes, it's a syntax error
INC SI ;else point to next byte
JMP SHORT FIND_BYTES ;and get rest of string.

REPLACE: CALL SPACE ;Parse spaces.
MOV FIND_CNT,CX ;Save count of find string bytes.
MOV CX,CX ;Reset counter to zero.
MOV DI,OFFSET REPLACES ;Point to replace string storage.
REPLACE_BYTES: CALL STRING ;Get string.
CMP BYTE PTR [SI],32 ;Are we now pointing to space?
JZ OPEN_FILE ;if yes, we are done here.
CMP BYTE PTR [SI],13 ;Are we now pointing to CR?
JZ OPEN_FILE ;if yes, we are done here
INC SI ;else, point to next byte
JMP SHORT REPLACE_BYTES ;and get rest of string.

;-----
; The exit is placed in the middle of code ;
; so it can be reached by short jumps. ;
;-----

EXIT: MOV AH,9 ;Display message
INT 21H ; and terminate.
INT 20H

;-----
; We are ready to open the file and read it into the buffer ;
; offset 20,000 bytes from the start. We will then move the ;
; bytes to the start of buffer, trading any match of find ;
; string with replacement string. ;
;-----

OPEN_FILE: MOV REPLACE_CNT,CX ;Save count of replace bytes.
MOV DX,FILE_START ;Point to ASCII filename
MOV AX,10000 ;and open file for reading.
INT 21H
MOV DX,OFFSET NOT_FOUND ;if not found
JC EXIT ;display message and exit.

READ_FILE: MOV SX,AX ;File handle into SX
MOV DX,OFFSET BUFFER+20000 ;Point buffer
MOV CX,40000 ;Attempt to read 40,000 bytes.
MOV AX,10FH
INT 21H
MOV DX,OFFSET TOO_BIGS ;Point to error message.
CMP AX,40000 ;Did we read 40,000 bytes?
JZ EXIT ;if yes, file too big; exit
PUSH AX ;save count of bytes
MOV AX,3FH ;and close the file.
INT 21H

COMPARE: POP DX ;Retrieve byte count.
MOV AX,FIND_CNT ;Retrieves find string length.
CMP DX,AX ;Is find string bigger than file?
JZ OK ;if no, it's OK
MOV DX,OFFSET CHANGES ;else exit with no change.
JMP SHORT EXIT

OK: MOV DX,OFFSET BUFFER+20000 ;Point to start of file
MOV AX,OFFSET BUFFER ;and start of storage.
NEXT_COMP: MOV SI,OFFSET FINDS ;point to find string
MOV DI,SX ;point to match attempt
MOV CX,FIND_CNT ;get find string length
REP CMPSB ;and compare
MOV DI,AX ;Point storage area.
JZ MATCH ;if match, store replace string
MOV SI,SI ;else store
MOVSB ;old byte
INC AX ;point to next storage spot
```

(Figure 1 continues)

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■ PROGRAMMING/UTILITIES

```

INC BX ; start of next byte to compare
DEC DX ; decrement file byte count
JMP SHORT LOOP ; end check if end of file.

MATCH: OR CHANGE_FLAG,1 ;Indicate that we found a match.
        SI,OFFSET REPLACES ;point to replacement string.
        MOV CX,REPLACE_CNT ;Get length.
        ADD AX,CX ; point to next storage spot
        ADD BX,FIND_CNT ; start of next byte to compare
        SUB DX,FIND_CNT ; subtract from file byte count
        REP MOVSB ; end store the string.

LOOP: CMP DX,FIND_CNT ;Is find string bigger then
        JNE NEXT_COMP ; balance of file? if no, next
        MOV CX,DX ; compare else, transfer the
        ADD AX,CX ; balance of file to write
        MOV SI,BX ; store eee.
        REP MOVSB

;-----
; We are ready to write the file to disk.
;-----

WRITE: PUSH AX ;Save length of new file.
        MOV DX,FILE_START ; point to ASCII filename.
        XOR CX,CX ; normal attribute
        MOV AH,3CH ; end create new file.
        INT 21H
        POP CX ;Retrieve file length
        SUB CX,OFFSET BUFFER ;It's in offset form; correct it.
        MOV BX,AX ;file handle into BX
        MOV DX,OFFSET BUFFER ; point to storage buffer
        MOV AX,4BH ; and write the file.
        INT 21H
        MOV AH,3BH ;Close file.
        INT 21H
        MOV DX,OFFSET CHANGES ;Point to "Not Changed"
        CMP CHANGE_FLAG,0 ;Did we find a match?
        JNE NOT_CHANGED ;if no, display ee is
        ADD CX,4 ; else bump pointer to "Changed"
        JMP EXIT ; and we are done.

NOT_CHANGED: JMP EXIT

;-----
; This subroutine will get the quoted string
; or convert the decimal ASCII to hexadecimal
; and store in the appropriate storage area.
;-----

STRING: CMP BYTE PTR [SI],'"' ;Is it quotes?
        INC SI ;if no, must be number
        INC SI ; else, point to first string
        NEXT_STRING: LODSB ; byte and retrieve.
        CMP AL,13 ;Is it carriage return?
        JE ERROR ;if yes, syntax error; exit.
        CMP AL,'" ' ;Is it quotes?
        JNE STORE ;if no, store the byte
        CALL DELIMITER ; else, see if delimiter
        JNC STORE ; end store the quote if part
        RET ; of string else, we are done.

STORE: STOSB ;Store the byte
        INC CX ; increment byte count
        JMP SHORT NEXT_STRING ; and get next string byte

NUMBER: XOR BL,BL ;Zero into hex counter.
GET_NUMBER: CALL DELIMITER ;Is it a delimiter?
        JNC LOAD_NUMBER ;if no, get next decimal number
        MOV AL,BL ; get hex byte
        STOSB ; end store
        INC CX ; increment byte count
        RET ; end we are done

LOAD_NUMBER: ;Get the decimal number
        CMP AL,'0' ;Is it between 0 and 9?
        JB ERROR ;if no, syntax error
        CMP AL,'9'
        JA ERROR
        SUB AL,30H ; else, convert to hex
        MOV BX,AL ; end save
        MOV AL,10 ; multiply by ten
        MUL BL ; to shift place left
        MOV BL,AL
        ADD BL,BX ; add new number
        JMP SHORT GET_NUMBER ; and get next decimal number.
ERROR: JMP EXIT ;In lieu of range of short jump.

```

(Figure 1 continues)

CHANGE
AT A GLANCE

CHANGE filespec findstring replacestring

Filespec, *findstring*, and *replacestring* must be separated by one or more spaces. *Filespec* may include a drive and path in addition to the filename.

Findstring and *replacestring* may consist either of text characters enclosed in quotation marks or of ASCII decimal codes separated by commas. Text strings in quotes and ASCII values in numerals may be combined in either string if separated by commas.

Maximum file length is 40,000 bytes.

tion that begins with the label BEGINNING and also includes the five subroutines at the end of the listing called STRING, STORE, NUMBER, SPACE, and DELIMITER.

The command line parameters you specify when using CHANGE are a filename and two strings. The two strings may also contain decimal ASCII codes. As CHANGE parses the command line, it saves the address where the name of the file begins in the variable FILE_START and stores an ASCII zero at the end of the filename. This turns the filename into an ASCII string, which is required by the file-handling function calls of DOS 2.0 and later.

CHANGE transfers the search string and the replace string to small 128-byte buffers (labeled FINDS and REPLACES,

■ More than half the code in CHANGE.ASM is dedicated to that tedious chore of parsing the command line.

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■ PROGRAMMING/UTILITIES

respectively) at the end of the program. Given the size of the program itself, the two 128-byte buffers to hold the search-and-replace strings, and the stack, CHANGE assumes it has 60,000 bytes left over in the 64K segment. This will almost certainly be the case unless you're running CHANGE under default conditions in an environment such as *TopView* or *Microsoft Windows*.

CHANGE uses the top 40,000 bytes of this 60,000-byte buffer to store the file that it reads in from the disk. The section of program beginning with the OPEN_FILE label shows how CHANGE opens the file and attempts to read 40,000 bytes. The value of AX returned from DOS Function

- **CHANGE** uses the powerful 8088 string instructions **CMPSB** and **MOVSB** for changing and transferring the file.

Call 3Fh (Read from File) is equal to the number of bytes DOS actually read. If AX is set to 40,000 at that point, then CHANGE will terminate with the error message "File too big."

CHANGE uses two separate (possibly overlapping) areas of the 60,000-byte buffer to hold the original and changed versions of the file. The original can occupy the top 40,000 bytes, and the changed version can occupy the bottom 40,000 bytes. As CHANGE grinds through the file making changes, it moves the file from the top of the buffer to the bottom.

CHANGE uses the powerful 8088 string instructions CMPSB and MOVSB for changing and transferring the file. It first uses REP CMPSB for comparing the original file with the search string. If REP CMPSB reports a match, CHANGE moves the replace string to the destination buffer. If not, it just moves the next character down and tries again. It continues until the remaining length of the original file is less than the length of the search string.

```

;-----;
; This subroutine will parse ;
; leading and delimiting spaces. ;
;-----;

```

```
SPACE:      INC     SI
            CMP     BYTE PTR [SI],32
            JE      SPACE
            RET
```

```

;-----;
; This subroutine will check ;
; for delimiter characters. ;

```

```

DELIMITER:    CLC          ;assume not delimiter.
CMP          BYTE PTR [SI],32 ;is it space
JE           SET_CARRY
CMP          BYTE PTR [SI],13 ; or carriage return
JE           SET_CARRY
CMP          BYTE PTR [SI],',' ; or comma?
JNE          RETURN          ;if no, return else, indicates
SET_CARRY:    SETC          ; by setting carry flag
RETURN:      RET

```

```

; Storage buffers for findstring, replacestring and file et
; end of code to make basic data listing appreciably shorter.

```

```
FIND$:
ORG OFFSET FIND$+128
REPLACE$:
ORG OFFSET REPLACE$+128
BUFFER:
```

```
CODE ENDS
END START
```

(Figure 1 ends)

```

100 REM -- BASIC PROGRAM TO CREATE change.com
110 OPEN "change.com" AS #1 LEN = 1
120 FIELD #1,L AS A$
130 CHECKSUM = 0
140 FOR I# = 1 TO 93
150   LINESUM = 0
160   FOR J# = 1 TO 8
170     READ B$B$
180     CHECKSUM = CHECKSUM + B$B$
190     LINESUM = LINESUM + B$B$
200   IF (B$B$ < 256) THEN LET A$ = CHR$(B$B$)
210   PUT I#
220 NEXT J#
230 READ LINESUMC#
240 IF LINESUMC# <> LINESUM THEN PRINT "Error in Line":200 + I# : I#
250 NEXT I#
260 CLOSE
270 IF CHECKSUM = 46976 THEN PRINT "Successful Completion": END
280 PRINT "COM file is not valid": END

290 DATA 233, 134, 8, 8, 8, 8, 8, 367
300 DATA 9, 8, 93, 121, 118, 116, 97, 120, 647
310 DATA 32, 101, 114, 114, 111, 116, 79, 692
320 DATA 100, 100, 100, 100, 111, 111, 116, 710
330 DATA 102, 111, 117, 110, 100, 36, 70, 185, 751
340 DATA 100, 101, 32, 116, 111, 111, 32, 98, 789
350 DATA 105, 103, 36, 70, 111, 116, 32, 67, 648
360 DATA 104, 97, 77, 119, 103, 101, 100, 36, 67, 710
370 DATA 111, 112, 121, 114, 105, 103, 104, 116, 806
380 DATA 32, 49, 57, 56, 54, 32, 90, 185, 475
390 DATA 102, 102, 45, 68, 97, 110, 105, 115, 752
400 DATA 32, 80, 117, 90, 109, 105, 115, 184, 735
410 DATA 103, 100, 103, 32, 67, 111, 46, 26, 608
420 DATA 00, 114, 111, 103, 114, 97, 109, 109, 837
430 DATA 101, 100, 32, 90, 121, 32, 77, 185, 666
440 DATA 99, 104, 97, 101, 109, 32, 74, 46, 661
450 DATA 32, 77, 101, 102, 102, 111, 114, 109, 735
460 DATA 26, 190, 120, 8, 106, 10, 1, 152, 793
470 DATA 232, 53, 1, 137, 54, 3, 128, 609
480 DATA 60, 13, 116, 63, 120, 60, 32, 116, 500
490 DATA 3, 70, 235, 243, 190, 4, 0, 232, 305
500 DATA 30, 1, 51, 201, 181, 225, 2, 332, 833
510 DATA 215, 0, 120, 60, 32, 116, 0, 120, 607
520 DATA 60, 13, 116, 31, 70, 235, 240, 232, 997
530 DATA 6, 1, 137, 14, 5, 1, 51, 201, 181
540 DATA 121, 97, 3, 232, 107, 6, 60, 809
550 DATA 32, 116, 14, 120, 60, 13, 116, 9, 499

```

(Figure 2 continues)

Figure 2: A BASIC program that will automatically create *CHANGE.COM*.



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■ PROGRAMMING/UTILITIES

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570 DATA	32,	137,	14,	7,	1,	139,	22,	3,	355
580 DATA	3,	184,	0,	61,	285,	32,	186,	22,	693
590 DATA	1	114,	232,	139,	216,	106,	1,	02,	971
600 DATA	105,	64,	156,	100,	63,	205,	33,	106,	1072
610 DATA	30,	1,	61,	64,	156,	116,	212,	00,	720
620 DATA	100,	62,	205,	33,	90,	161,	5,	1,	737
630 DATA	59,	205,	125,	5,	106,	51,	1,	235,	070
640 DATA	194,	107,	1,	02,	104,	225,	3,	190,	1066
650 DATA	225,	2,	139,	251,	139,	14,	5,	1,	776
660 DATA	243,	166,	139,	240,	136,	0,	139,	243,	1302
670 DATA	164,	64,	67,	74,	235,	24,	120,	14,	770
680 DATA	9,	1,	1,	190,	97,	3,	139,	14,	454
690 DATA	7,	1,	3,	193,	3,	30,	5,	1,	243
700 DATA	42,	22,	5,	1,	243,	164,	59,	22,	559
710 DATA	5,	1,	125,	203,	139,	202,	3,	193,	071
720 DATA	139,	243,	240,	164,	00,	139,	22,	3,	1033
730 DATA	1,	51,	201,	100,	60,	205,	33,	09,	020
740 DATA	129,	233,	225,	3,	139,	216,	106,	225,	1356
750 DATA	3,	100,	64,	205,	33,	100,	62,	205,	932
760 DATA	33,	106,	51,	1,	120,	62,	9,	1,	471
770 DATA	0,	116,	3,	131,	194,	4,	233,	02,	763
780 DATA	255,	120,	60,	34,	117,	20,	70,	172,	056
790 DATA	60,	13,	116,	40,	60,	34,	117,	6,	455
800 DATA	232,	52,	0,	115,	1,	190,	170,	65,	030
810 DATA	235,	237,	50,	219,	232,	40,	0,	115,	1120
820 DATA	5,	130,	195,	170,	65,	195,	172,	60,	1000
830 DATA	40,	114,	10,	60,	27,	119,	14,	44,	077
840 DATA	40,	130,	240,	176,	10,	240,	227,	130,	1231
850 DATA	216,	2,	223,	235,	233,	233,	19,	255,	1406
860 DATA	70,	120,	60,	32,	116,	250,	195,	240,	1099
870 DATA	120,	60,	32,	116,	10,	120,	60,	32,	527
880 DATA	116,	5,	120,	60,	44,	117,	1,	249,	720
890 DATA	195,	0,	0,	0,	0,	0,	0,	0,	195
900 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
910 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
920 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
930 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
940 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
950 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
960 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
970 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
980 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
990 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1000 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1010 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1020 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1030 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1040 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1050 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1060 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1070 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1080 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1090 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1100 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1110 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1120 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1130 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1140 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1150 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1160 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1170 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1180 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1190 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1200 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0
1210 DATA	0,	0,	0,	0,	0,	0,	0,	0,	0

(Figure 2 ends)

CHANGE maintains two pointers to the original version and the changed version within its buffer. If the length of the search string equals the length of the replace string, then the two pointers will always be 20,000 bytes apart. In certain unusual cases (such as replacing many occurrences of a short string with a much larger string), the pointer to the changed file could conceivably "catch up" to the pointer to the original file and create problems. If you will be making changes like this to a file, for your own protection you

should be sure to back up the original. If the changed file grows to about 65,000 bytes or so, it will collide with the stack at the top of the segment and crash. In normal cases, this will not happen.

After the search-and-replace is complete, all that remains is for CHANGE to write out the new version of the file to the disk. It effectively erases the existing file with Function Call 3Ch (Create a File) and then just writes out the contents of the buffer and closes the file. If you normally run with BREAK ON, be sure not to try to

DOWNLOADING CHANGE

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CHANGE.BAS, whether typed in or downloaded from PC-IRS, will automatically create CHANGE.COM when run once in BASIC. CHANGE.ASM, listed both here and on PC-IRS, allows you to modify the program but requires that you use a macro assembler (IBM or Microsoft) and the following commands:
 MASM CHANGE;
 LINK CHANGE;
 EXEBIN CHANGE.CHANGE.COM
 —Craig L. Stark

break out of CHANGE while it's running. If you happen to break out at Function Call 40h, you'll be left with an empty file on the disk.

Subject to that caveat, you'll find CHANGE both fast and easy to use—traits shared by all-too-few word processors. So, next time you need to modify strings in a file, just CHANGE them.

Michael J. Mefford is a microcomputer consultant who works out of his home in Gleneden Beach, Oregon.

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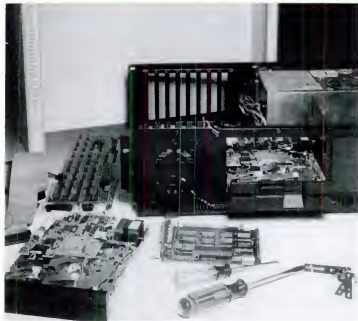
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SPREADSHEET CLINIC



Here are two different approaches that make macro creation easier by translating the 1-2-3 column numbers returned by @cell into letters.

FINDING THE COLUMN LETTER

The @cell command in 1-2-3, Release 2.0, gives you a column number rather than a letter. That is, column A is 1, column B is 2, etc. When you write macros it may be useful to translate the number back to a letter. The long formula in cell B6 of Figure 1 does this. You can copy it anywhere in the spreadsheet, and it will return the letter of the column it is in. It uses the @mid function to pick the right letters from cell D14, which contains a space then the letters of the alphabet. Cell D14 has the range name ALPHABET.

Since column letters start over with AA after you get to Z, counting them is like working in base 26. The rightmost letter is like the "ones" digit and changes each time you move one column to the right. The left letter is like the "tens" digit (or "twenty-sixes" digit) and changes every 26 columns.

The formula works by dividing the column number by 26 to determine the leftmost "twenty-sixes" letter. If the column number is 27 (column AA) or larger, the formula returns one letter from the alphabet string, but it returns no letters for the first 26 columns. The second part of the equation determines the rightmost "ones" letter. It uses the @mod function, which calculates the remainder of the column number after dividing by 26. The two results are joined with the ampersand (&) to give a one- or two-letter column number.

Ted Hollenberg
New York, New York

I admire your facility for 26-base

	A	B	C	D	E	F	G	H	I	J	K
3											
4											
5											
6	B										
7	>>>> Actual Column Letter Calculated for Cell B6										
8	Formula in cell B6:										
9											
10											
11	@MID(\$ALPHABET,\$CELL("COL",B7..B7)/26-8,1,\$CELL("COL",B7..B7) [Cont.]										
12	>26)&MID(\$ALPHABET,\$MOD(\$CELL("COL",B7..B7)+1,26)-1,1)										
13											
14	"ALPHABET" >> _ ABCDEFGHIJKLMNOPQRSTUVWXYZ										
15	RANGE										
16											
17	String starts with a space.										
18											

Figure 1: A formula that calculates the column letter from the column number.

	C	D	E	F
3			1	A
4			2	B
5			3	C
6		D	4	D
7			5	E
8			6	F
9			7	G
10			8	H
11			9	I
12			10	J

Formula in D6:
=VLOOKUP(\$CELL("col",D7..D7), \$E\$3..\$F\$12,1)

Figure 2: An alternative technique to that in Figure 1, this method uses a vertical lookup table to find the column letter of a cell.

arithmetic. I'm not sure I could have written that formula. However, you can get the same results with a vertical lookup table, such as that shown in Figure 2. Here the table is in cells E3 to F12, and I have included only the letters A through J for brevity. The formula in D6 will display the letter of the column it is in.

In both methods, the @cell function refers to a cell other than the one with the formula to avoid a CIRC error.

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■ EDITED BY NEIL J. RUBENKING

TURBO POWER USER



Turning procedures into overlays provides a fast and effective technique for debugging, tracking passed parameters, and finding internal Turbo Pascal data.

DEBUGGING WITH OVERLAY

After reading Charles Petzold's tip in "Using DEBUG with Turbo," (Power User, Volume 5 Number 9), I'd like to submit a method for debugging individual procedures by using Turbo's greatest debugging aid: the overlay.

The steps are simple and the results dramatic. First, change the procedure (or function) into an overlay by adding the reserved word **OVERLAY** to the procedure declaration, as shown in Figure 1. Next, compile the program (it doesn't matter whether it's compiled to disk or in memory). This produces a binary file with the extension .000, which you can unassemble with **DEBUG**, as shown in Figure 2. Once you've unassembled the routine, you can easily convert it into **INLINE** statements.

The format of the overlay file is simple, and the relevant code is easily found: **DEBUG** always loads it starting at offset \$0100.

This technique has helped me solve many problems, from determining the proper methods to pass and receive parameters, to finding out where Turbo's internal data (e.g., the Color Attribute Byte and the Current Window Coords) is stored. It works for all versions of Turbo from 2.0A to the current 3.01A.

Richard R. Sands
Portland, Oregon

*Unless you're an assembler whiz, it's not easy to write **INLINE** or **EXTERNAL** functions for Turbo Pascal. Keeping track of how to address the parameters, local variables, and function results can all cause*

```
Program Test; { Creates an overlay for debugging purposes }

OVERLAY function inc(x:Integer):Integer;
begin
  inc:=succ(x);
end;
begin { Needs a begin/end. for no-error compilation }
end.
```

Figure 1: In this sample program the code Turbo generates to perform the **SUCCESSOR** operation will be stored in an overlay file.

```
C>DEBUG Test.000
-u 100
xxxx:0100 E818DF      CALL     E81B          ; Turbo
                    PUSH     DS          ; Overlay
xxxx:0103 1E          ADD     [BX+SI+552D],BH ; Mgmt
xxxx:0104 00B82D55    MOV     BP,SP        ; Start ---
xxxx:0108 8BEC        PUSH     BP        ; Of
xxxx:010A 55          JMP     @10E         ; Code
xxxx:010B E90000      INC     AX, [BP+04]
xxxx:010E 8B4604      MOV     AX, [BP+06], AX
xxxx:0111 40          JMP     @118
xxxx:0112 894606      MOV     [BP+06], AX
xxxx:0115 E90000      JNC     @118
xxxx:0118 8B4606      MOV     AX, [BP+06]
xxxx:011B 8BES        MOV     SP, BP
xxxx:011D 5D          POP     BP
xxxx:011E C20400      RET     0004
-q
```

Figure 2: A **DEBUG** unassembly listing of the overlay file created for the program shown above in Figure 1.

hair-tearing. This technique makes it a lot easier, and you can be sure I'll use it next time I need to write a function in **INLINE** code.

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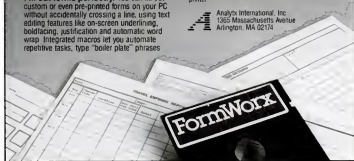
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■ USER-TO-USER

```

R CONTROL.COM
A
MOV SI,0000      ;INITIALIZE INDEX POINTER
MOV BX,00        ;SET UP BX AS LINE LENGTH
MOV DL,[SI+0000] ;GET PARAM. LINE LENGTH
INC SI
MOV DL,[SI+0000] ;GET PARAMETER DATA BYTE
CMP DL,2F        ;COMPARE FOR ASCII >= 8
JLE E13F         ;NOT INTERESTED
CMP DL,3A        ;COMPARE FOR ASCII <= 9
JGE E13F         ;NOT INTERESTED
MOV AL,00        ;CLEAR AL TO USE FOR BUILDING CODE
SUB DL,30        ;ADJUST ASCII CODE TO DATA DIGIT
ADD AL,DL
INC SI
CMP SI,BX        ;POINT TO NEXT DATA BYTE
JG E130          ;COMPARE FOR END OF PARAM LINE
MOV DL,[SI+0000] ;END OF PARAMETER DATA LINE
CMP DL,2F        ;GET NEXT DATA BYTE
JLE E130         ;COMPARE FOR ASCII >= 8
JGE E130         ;FINISHED BUILDING THIS CODE
CMP DL,3A        ;COMPARE FOR ASCII <= 9
JLE E130         ;SAME
MOV CL,0A        ;ANOTHER DIGIT - MULT. BY 10
MUL CL           ;ADD AND GET NEXT DATA BYTE
JMP E11A         ;REGISTER SETUP FOR PRINTER OUTPUT
MOV AH,00        ;HIDE PRINTER INTERRUPT
MOV DX,0000      ;POINT TO NEXT DATA BYTE
INC SI           ;COMPARE FOR END OF PARAM. LINE
JMP E11A         ;NOT DONE - START LOOP OVER
MOV AB,4C        ;TERMINATE A PROCESS
INT 21

RCX
4E
H
0

```

Figure 2: CONTROL.SCR script to create CONTROL.COM utility to send codes to LPT1. Enter this using the DOS COPY CON command or any pure-ASCII word processor. Be sure to leave a blank line above RCX and hit the Enter key after every line, especially the last one. (You don't have to type in the comments following the semicolons.) Then create the file with the command `DEBUG < CONTROL.SCR`

LEAST RESISTANCE

Michael J. Mefford's reset switch (User-to-User, Volume 5 Number 15) may work for a while, but it may eventually destroy transistor Q4 in the power supply, which generates the "power good" signal. When the button is pressed, this transistor is connected across the 5-volt supply with no resistance to protect it, and it quickly overheats.

To protect the transistor, splice a 330-ohm resistor into the "power good" lead between the power supply and the system board. Of the nine power wires that go to the system board, this is the one closest to the edge. It goes to pin 1 of connector P8, easily recognized because pin 2 of P8 is unused.

The "power good" signal goes directly to pin 11 of the 8284. To reset the computer, you can ground it either there (as Mr. Mefford suggested), or at the point where it enters the system board. Note: The circuit of the power supply is given in Howard W. Sams's Computerfacts, although it

is not in any of IBM's manuals.

Michael A. Covington
Athens, Georgia

Reader Yiannis Papelis of Carbondale, Illinois, also pointed out that it wouldn't hurt to connect a resistor in line. This will protect your system if you have a habit of leaning on switches; as we said in the original article, all you really have to do is tap the reset button lightly to reboot your system. And again, unless you're awfully handy with a soldering iron, consider all the risks before chopping away at your system board.

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■ CHARLES PETZOLD

PC TUTOR



Straightening out an ANSI.SYS PROMPT mystery so you can print a DIR listing, and testing for replaceable parameters in batch files.

ANSI ON THE PRINTER

I've been using ANSI.SYS and the PROMPT command to set my screen colors as you recommended in "Color Me Anything" (PC Tutor, Volume 4 Number 20). My AUTOEXEC.BAT has the following command:

```
PROMPT $e[35;44;1m$p$g$e[33;44;1m
```

Aside from the colors, the prompt now shows the current drive and directory.

The problem comes when I toggle the printer echo with Ctrl-PrtSc—to print a DIR listing, for example. Part of the string that follows the PROMPT command gets printed instead of the prompt I see on my screen. Know any way I can fix this?

John J. Gray
Marysville, Ohio

Sure do: Don't use printer echo. Use redirection of output instead. When you want to print a DIR listing, simply execute

```
DIR >PRN
```

Or you could put your PROMPT command in its own separate batch file (say PR.BAT) and issue a PROMPT without any parameters before toggling printer echo. This returns your prompt to normal before you print. Then, after you've toggled printer echo off, execute PR.

Although the problem of echoing the ANSI prompt on the printer looks a little strange when you first see it (because what you see being printed is not what you see on the screen), it's really fairly simple. The command processor, COMMAND.COM, is in charge of displaying the DOS prompt.

The prompt it tells DOS to display looks much like the string that follows the PROMPT command, except that COMMAND substitutes the ASCII Escape code (27 or 1B in hexadecimal) for the \$e, the current subdirectory for \$p, and the right angle bracket for \$g.

COMMAND sends the string to DOS, and DOS sends the string to the device driver ANSI.SYS to be displayed to the screen. ANSI.SYS recognizes the two strings that begin with an Escape code as control sequences. It doesn't display them but instead does something else. (In your case, it changes the screen color, for example.) However, when you have printer echo toggled on, DOS blindly sends the same string out to the printer. Your printer gobbles up the Escape code and probably the left bracket also, but then gives up and prints the rest of it as is.

Some PC printers actually respond to ANSI control sequences. However, since

IBM's control sequence to change colors is not part of the standard ANSI control sequence set, these printers, too, would probably not respond well to the prompt you're using.

BATCH FILE PARAMETERS

I have a question about batch files. I am trying to prevent the omission of an important batch file parameter by using an IF command within the batch file. But if I use

```
IF %1== GOTO ERROR
```

I get a "Syntax Error" from DOS.

Is there any way to check for the case of a null batch file variable?

Mark Fischer
New Orleans, Louisiana

Sure. It's an old trick, but worth repeating. Just put some other character on both sides of the double equal sign. I usually use a slash:

```
IF /%1==/ GOTO ERROR
```

One of the best ways to learn about batch file tricks is by exploring the installation programs that software manufacturers often ship with their products. I recently encountered a batch file that was an incredible 13K long, and all it did was install some laser printer drivers on a hard disk.

ASK THE TUTOR

The PC Tutor solves practical problems and explains points of general interest. To see your questions answered here, drop a line to PC Tutor, PC Magazine, One Park Avenue, New York, NY 10016.

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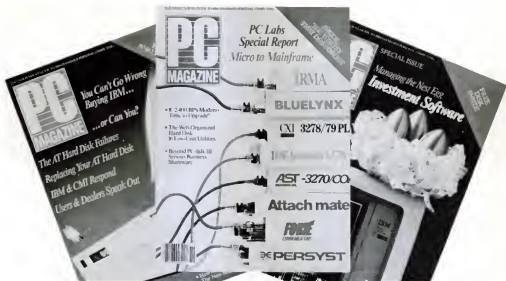
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- Hardware**
- a. ☐ Mainframe
 - b. ☐ Mini
 - c. ☐ PC
 - d. ☐ Printer/Plotters
 - e. ☐ Monitors
 - f. ☐ Terminals
 - g. ☐ Modems

- h. ☐ Hard Disk/Tape Back-up
- i. ☐ Add-in Boards
- j. ☐ LANs
- k. ☐ Micro-Mainframe Links

Software

- l. ☐ Communications
- m. ☐ Accounting
- n. ☐ Spreadsheets/Financial
- o. ☐ Project Managers
- p. ☐ Word Processors
- q. ☐ Database Managers
- r. ☐ Graphics

- 2) Your primary job function is (check)**

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- t. ☐ MIS/DP/Communications Systems, Programming
- u. ☐ Engineering/R&D
- v. ☐ Finance/Accounting
- w. ☐ Marketing/Sales

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- y. ☐ Evaluation
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PC11/11-1

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